No. 1807
Vol. XLIV

1/-

FLIGHT

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and The AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

AUGUST 12th, 1943

OFFICE OF V. P. ENG.
OCT 19 1943

DATE		INFO.	ACTION
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SAVED 20 AIRMEN

Twenty airmen, members of the crews of three R.A.F. planes which made forced landings on the sea, were saved by Air-Sea Rescue launches and aircraft on Thursday. Nine of the men were survivors of a Sunderland, which "went in" 120 miles out in the Atlantic.

From THE DAILY MAIL, April 17th, 1943

The Prototype of the R.A.F. high speed air-sea rescue launches was designed and built by

THE BRITISH POWER BOAT COMPANY LTD.

BRITAIN'S STRENGTH IN THE SKIES.

"This machine has proved one of the great aircraft of the war."
News Chronicle.

FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

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The Outlook

The Rumanian Oilfields

THE bombing of Ploesti by a strong American force of Liberators marks a new stage in the war. Two or three times the Russians have sent bombers over the Rumanian oilfields, but they have not kept up a sustained attack on the area. Strategic bombing is not yet part of the Russian war plans. They believe, and evidently with good reason, that there is more profitable work for their heavy bombers nearer home at the present stage of the war. The Middle East Command has had it in its power for a long time past to send comparatively small forces over these oilfields, and once some American machines made the attempt.

The wells themselves are small and difficult targets, which bomb-aimers could scarcely reckon on hitting, and the pipes which carry the oil away in different directions are underground, and could only be punctured by chance shots. The refineries are the only targets worth consideration, and they call for the employment of a large force if anything like crippling damage is to be done. Repeated attacks also seem to be called for.

The prize of successful bombing of Ploesti is well worth a great effort. In fact, scarcely any conceivable target offers such immediate and remunerative dividends. Oil is admittedly the Achilles heel of the Axis and, whereas the destruction of weapon factories may, for the present, only mean calls on the reserves which Hitler built up before the war, the cutting off of one-third of the Axis oil supplies must put difficulties in the way of the extensive campaigns which the Germans are now waging. Last summer's disastrous effort to reach the oilfields of the Caucasus was proof of the crying need of Germany for more supplies of oil. The American Ninth Air Force in the Middle East has now accumulated some strength, and we hope that this first attack on Ploesti is only the forerunner of many others.

Government Bashfulness

SO far as post-war civil aviation is concerned, the British Government reminds us of the old lady who had seen better times but had been reduced to trying to sell flowers in Piccadilly Circus. In a very half-hearted attempt to advertise her wares she merely said in a low voice, "Violets!" and then, in an aside, "I do hope nobody hears me."

The Government seems to feel that if it even admitted that it had been toying (in its spare time!) with some sort of plan for doing *something* in the way of civil aviation after the war, not only our Allies but the Empire would be as shocked as the friends of the old lady. The contrary is, of course, the case. They are looking, and so far looking in vain, for a lead from this country.

Mr. Hudson Fysh, on page 170 of this issue, asserts that without post-war parity in air transport the Empire cannot survive, and that the Empire is a necessary partner in the task of maintaining, with our good friends the Americans, peace and concord in the post-war world. Last week we referred to Viscount Bennett's recent remark that the air can unite the Empire, and we added that we would go farther and say that the Empire can *only* be united by air. Mr. Hudson Fysh, an Australian with views typical not only of his own country but of the other parts of the Empire, is equally emphatic.

The "Old Lady" in Whitehall need not be afraid of her friends hearing her. They are waiting to hear her, and they will applaud her for her courage when at last they hear her announcing, loudly enough for all the world to understand, that she does have violets to sell—and is proud of it!

Cards on the Table

THE hesitancy shown by Government spokesmen (by the Air Minister most recently in his reply in the House of Commons on August 4th) is the less understandable since America has already begun quite openly to lay her plans. Yet Sir Archibald Sinclair could, as recently as that, merely reiterate the old threadbare statement that "Consultations are going forward about these matters with His Majesty's Governments in the Dominions and with the Government of India, and we are awaiting replies to certain communications." We seem to have been awaiting these replies, or some very similar, for quite a while, and if any Dominion is tardy in making up its mind, it would probably be a very useful prod if the rest got together without waiting for the laggard.

By way of showing that the United States is not letting the grass grow under her feet, it may be pointed out that already the Civil Aeronautics Board is being empowered to manage an orderly post-war disposal of surplus aircraft. In this country we cannot, apparently, even settle on a few broad outlines.

America's aircraft manufacturing industry has put forward proposals, through the Post-war Development Committee of the Aeronautical Chamber of Commerce, designed to avoid the dumping of military aircraft on the market to compete with privately produced machines. This is in reply to the 17 questions on civil aviation issued by the Civil Aeronautics Board in May.

Operating companies also are getting busy. The president of Transcontinental and Western Air, Inc. (TWA), Mr. Jack Frye, has revealed to our contemporary, *American Aviation*, that his firm is making a study of the extent to which nations of the world could be helped after the war by the United States setting up national airlines. The idea would be for America to start foreign nations going with American aircraft and American personnel, and to train national personnel until such time, perhaps in from 10 to 20 years, as the nation in question was able to operate its own airlines.

Mr. Jack Frye admits frankly, and why on earth should he not, that "such a plan would be of great benefit to both the U.S. manufacturing and the air transport industry in that American equipment would be in actual use in many parts of the world, and these countries would look to the U.S. for replacements."

Contrast these frank and open declarations of intentions with our own feeble talk about "consultations going forward" and "awaiting replies to certain communications." If Whitehall imagines that is the way to get on with our American friends, then one can understand many things which previously were obscure.

Just before the recess, four Conservative British Members of Parliament presented a memorandum on Air Transport Policy. It deals with the British problem in its international, Empire and national aspects. Details will be published in next week's issue, but in the meantime it may be said that the memorandum is in favour of international regulation but not operation; a modicum of competition, financial aid where necessary.

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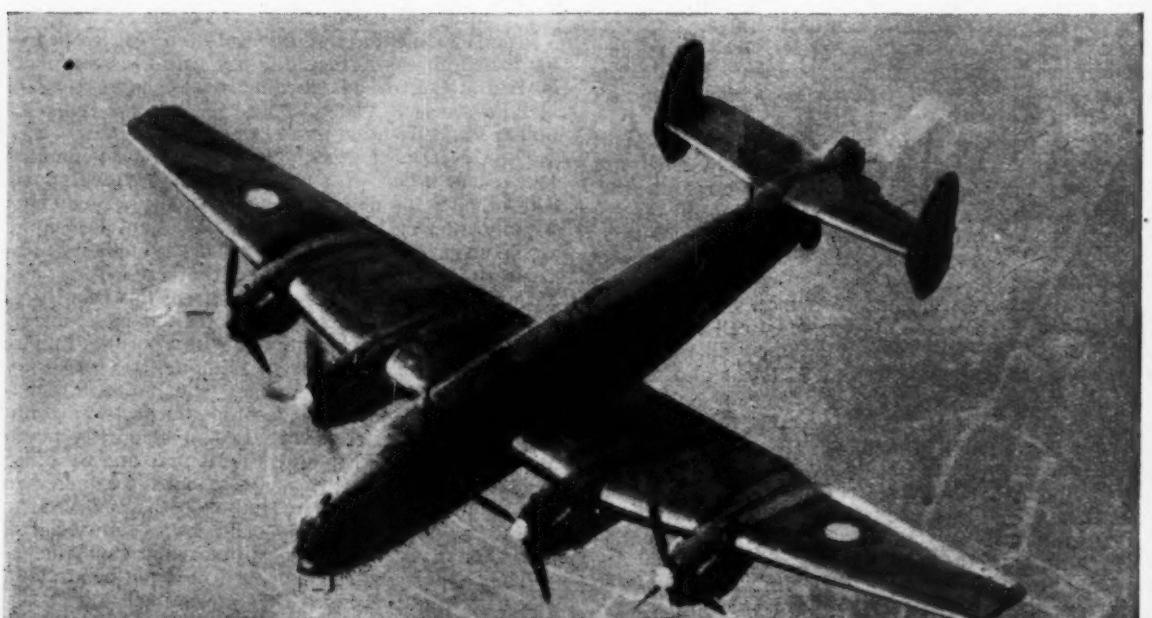


FLYING ON ONE: An official photograph of a Handley Page Halifax flying with three of its four Rolls-Royce Merlins stopped. To give confidence, the ability to do this is demonstrated to all Halifax crews under training.

THE NEW LODGER: A Spitfire at its dispersal point on Pachino airfield in Sicily. The Me 109 in the foreground is the late owner of the site.

WAR in the AIR

Many Victories : Sicily, Orel, Bielgorod : Rumanian Oilfields Bombed : The Fate of Munda

WHEN Marshal Badoglio succeeded Mussolini as Prime Minister of Italy the Allies held back their Strategic Air Force for a week to allow the new Government time to make up its mind and to get Italy out of the war. With the disappearance of *Fascismo* there is no reason left for Italy to sacrifice herself. However, it soon appeared that the new Government had no mind to make up, and so the Allied heavy bombers, were unleashed again, and Naples, Reggio and other places were once more subjected to unpleasant visitations.

By the end of July General Alexander had moved up what reinforcements, squadrons and supplies of ammunition he thought necessary into Sicily, and on August 1st he started an attack on the German positions all along the line. The Allies hold two great advantages, complete command of the sea and complete command of the air. Yet in the special circumstances of Sicily these two advantages are not decisive, as they would be in most campaigns. The Germans did undoubtedly contrive to get more troops across into the island, and to supplant nearly all the Italian divisions in the defensive ring round Etna. The Tactical Air Force of the Allies has done its utmost to support the ground troops in their assaults, taking every sort of risk to "soften" the defensive positions of the Germans. But the terrain is mountainous, and that is a tremendous handicap to a tactical Air Force, even though it is absolutely unopposed in the air. On a steep hillside a bomb needs to score an actual bullseye if it is to have much effect, and a miss, even a very near miss, may well be literally as good as the proverbial mile. Tanks seldom appeared in the fighting, and the assault was carried on mainly by the infantry and artillery. The reports have not told

POLAR PASSAGE: Scraping the snow and ice off the Grumman Avengers and flight deck on a U.S. carrier during a North Atlantic voyage.

WAR IN THE AIR

us whether General Alexander was well supplied with the types of gun which have been proved to be most effective in mountain warfare.

Guns, however, must have been playing their part, for the correspondent of *The Times* in Sicily has written that the hill fortress of Centuripe must have been impregnable in pre-artillery days, but it was duly stormed by the famous 78th Division of the Eighth Army, and it was the capture of this place which apparently led to the fall of Catania a few days later. The latter place was not, apparently, stormed, but evacuated by the Germans when they found that they had better go while the going was comparatively good. The town had been badly knocked about by our bombers. The retreating Germans had to go back towards Messina by the coast road which runs between Etna and the sea, and that road was under fire from the fleet as well as from pursuing aircraft.

With the opening of this assault the George Cross island of Malta is able to look back on a very satisfactory month's work in July. During that month R.A.F. squadrons based on the island destroyed for certain 200 enemy aircraft, of which 62 fell to intruders and night fighters. The island became one vast airfield, into which squadrons of Spitfires from Africa crowded, only to move on to bases in Sicily as they became available. Their places were taken by Kittyhawks. General Eisenhower moved his headquarters into the island in preparation for the great Sicilian battle. In addition, Beaufighters from Malta ranged far afield, and even attacked a hostile seaplane base in Greece.

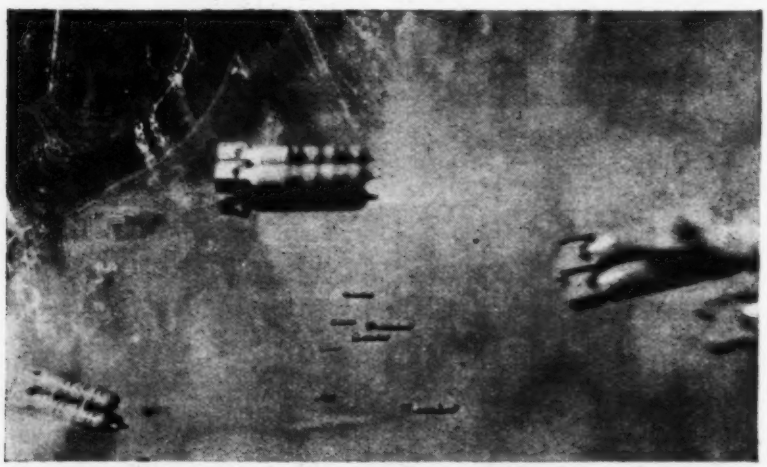
In the week before the invasion of Sicily began no less than 2,000 sorties were made by aircraft, mainly from Malta, on the 25 airfields in Sicily, and they were very heavy raids. In order to hurry on the business an airfield was constructed on Gozo island (next to Malta) in just over a fortnight, while Pantellaria also became a base for the N.A. Air Forces. This attack on the Sicilian airfields, accompanied by many attacks on others in the toe of Italy, was mainly responsible for the complete air ascendancy enjoyed by the Fifteenth Army Group as it took possession of Sicily.

SICILIAN SORTIES: Baltimore aircrews reporting to intelligence officers during combined operation.

Other Triumphs

THE raid on the oil refineries at Ploesti, in Rumania, by U.S. Liberators in daylight was one of the most enterprising operations so far conducted in this war. The crews specially trained for it over a "mock-up" of the area built up in Africa, and their bombers were fitted with special bomb-sights for aiming from a low level. The Germans had always realised the possibility of such an attack, and the oilfields were strongly defended, by balloons as well as *flak* and fighters. As we write, detailed reports have not yet been received, and it is not yet possible to assess the precise or probable damage done to the supplies of oil on which the Germans have been counting, but it is believed to have been serious. The flight, by the route chosen, involved a round trip of 2,400 miles or so, and on the return flight eight Liberators were forced down on Turkish territory through having run out of fuel. Mr. Stimson, the U.S. Secretary for War, has stated that 20 per cent. of the raiders were lost, which he did not consider excessive, considering the "devastating" blow struck.

In recent daylight raids in the West the American aircrews have noticed that some of the German fighters which have come up against them have been painted black, clearly for use by night, and also that twin-engined fighters, Ju 88s, Me 110s and 210s, have been used to repel day attacks. This shows that the Germans are now very short of fighters and must use anything which comes handy. They cannot any longer pick and choose. Fortresses are notoriously difficult for fighters to tackle by day, and the comparatively clumsy twin-engined fighters must suffer more from the battery of guns in each Fortress than the more nimble Fw 190s are likely to do.



IN BUNDLES OF THREE: Clusters of incendiary bombs falling from U.S.A.A.F. Fortresses during the big daylight raid on Hamburg. At the time of the attack the town was still on fire from the R.A.F.'s attack the previous night.

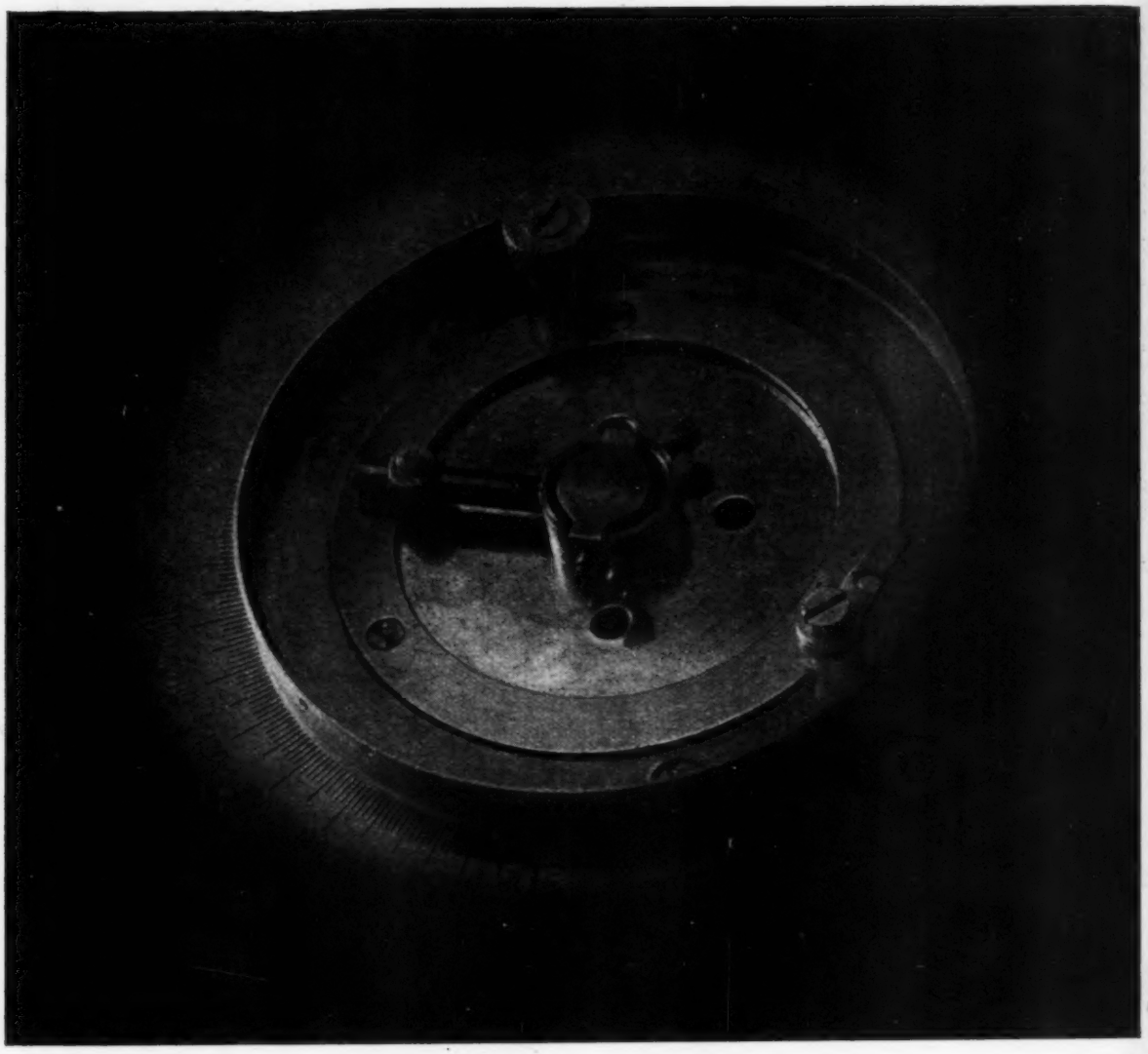
Good News from Russia

HITLER has had a very depressing week. In addition to the news from Sicily, the Russians have captured the two important towns of Orel

Hawker Typhoon—Britain's fastest single engine fighter. Highly manœuvrable and armed with either four 20 mm. cannon or twelve 0.303 machine guns, it is the most formidable fighter in the world to-day.

"Flight" photograph.

[Advt.]



Crystal Analysis

CRYSTAL analysis is the scientific approach to the atomic structure of substances. The apparatus employed is an X-ray spectrographic camera which enables photographs of X-ray diffraction by crystals of magnesium to be made. The axis of the arm shown in the illustration continues down into the centre of a cylindrical chamber and on it is mounted the crystalline specimen. This is bathed in a monochromatic X-ray beam and a photograph of the diffraction pattern made by the reflected rays is taken on a film which lines the chamber wall.

The application of the science of crystallography to the metallurgy of magnesium and its alloys has led to our present knowledge of the structure of the magnesium crystal, the number of phases which exist in the alloys, the orientation of crystals in worked material and the measurement of internal stresses.

The results of this research are constantly applied in practice to maintain for MAGNUMINIUM magnesium alloys their position in the forefront of the light alloy industry.

MAGNUMINIUM

The Lightest Structural Metal

MAGNESIUM CASTINGS & PRODUCTS LTD · SLOUGH

ENEMY AIR LOSSES TO AUGUST 7th

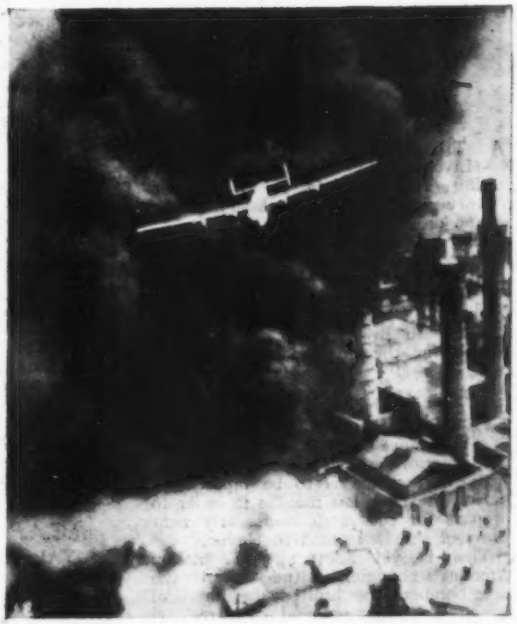
	Over G.B.	Continent	Middle East	N. Africa
July 25	4	10	0	3
" 26	1	4	0	40
" 27	0	21	0	5
" 28	0	2	0	3
" 29	1	11	0	1
" 30	2	3	0	26
" 31	1	2	0	3
Aug. 1	0	0	51	13
" 2	0	5	0	6
" 3	0	2	1	4
" 4	0	0	0	16
" 5	0	0	0	0
" 6	0	0	0	2
" 7	0	0	1	7
	9	60	53	129

Totals: West, 7,193; Middle East, over 5,533; North Africa 2,734.

BRITISH & U.S. AIR LOSSES to AUG. 7th

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
July 25	0	44	8	0	1
26	0	24	4	0	3
27	0	18	2	0	3
28	0	23	1	0	1
29	0	38	2	0	4
30	0	30	11	0	1
31	0	1	2	1	0
Aug. 1	0	0	0	20	1
2	0	30	3	0	7
3	0	0	5	0	2
4	0	1	0	0	9
5	0	0	0	0	8
6	0	0	3	0	8
7	0	2	0	0	14
	0	211	41	21	62

Totals: West, 7,062; Middle East, about 2,212; North West Africa, 1,007.



PLASTERING PLOESTI: One of the 9th Air Force Liberators delivering its attack on the Rumanian oil refineries during the great daylight raid on August 1st.

and Bielgorod. Marshal Stalin has issued an Order of the Day in which he points out that the belief that the Russians could only advance in the winter and that the summer was "Germans' weather" has now been shattered. We may feel sure that the shortage of German fighters on the Russian front contributed in no small degree towards this resounding success by the Red Army.

General MacArthur's cautious advance against Munda, in New Georgia, has been crowned with success, and the airfield there has been found to be not too badly battered by his bombs. It will soon be a base for attacks on Rabaul.

On last Saturday night home-based bombers made simultaneous heavy raids on Milan, Turin and Genoa, and found that the defences of these places had not been strengthened. There was little flak, few night-fighters, and the searchlight crews were inexperienced. That is significant.

A.T.A. BENEVOLENT FUND

Latest Subscriptions Bring Total Over £7,700

FOLLOWING a new appeal for funds to aid dependents who may suffer through accidents while in the service of Air Transport Auxiliary, many contributions to the fund have to be acknowledged. In the latest appeal, issued jointly by E. Colston Shepherd, B.A. (*The Aeroplane*) and G. Geoffrey Smith, M.B.E. (*Flight*), who are vice-presidents, it was mentioned that there have been over 80 deaths, not to mention injuries to personnel, in the course of the past three years. When it is remembered that during that period over one hundred thousand aircraft have been moved, this is not an undue casualty rate. Problems in the matter of relief arise and many cases have already been helped through the limited available funds. Subscriptions already acknowledged total £6,614 18s. 7d., and with those recently received but not yet published, the total is £7,712 11s. 7d. In addition, there is an amount of £2,775 17s. 7d. contributed by members of the Air Transport Auxiliary and the British Overseas Airways Corporation.

Amount previously acknowledged (excluding contributions from A.T.A. and B.O.A.C.)	£6,614	18	7
Tube Investments, Ltd.	50	0	0
Southern Aircraft (Gatwick), Ltd.	26	5	0
Ambrose Shardlow and Co., Ltd.	25	0	0
The Chase Non-Ferrous Metal Co., Ltd.	21	0	0
Hertfordshire Rubber Co., Ltd.	10	10	0
Jones, Stroud and Co.	10	10	0
Rediffusion	10	10	0
George Parnall	10	10	0
W. J. Reynolds (Motors), Ltd.	10	10	0
Telephone Manufacturing Co., Ltd.	10	10	0
Boneham and Turner, Ltd.	5	5	0
British Technical Products, Ltd.	5	5	0
E. G. Brown and Co., Ltd.	5	5	0
Earle, Browne and Co., Ltd.	5	5	0
V. H. Graesser	5	5	0
Grid and Young	5	5	0
Hallam, Sleigh and Cheston	5	5	0
G. Johnson Bros.	5	5	0
Kingfisher, Ltd.	5	5	0
Mining Engineering Co., Ltd.	5	5	0
The Monaco Motor and Engineering Co., Ltd.	5	5	0
A. R. Parsons and Co.	5	5	0
Phœnix Works, Ltd.	5	5	0
Pulman and Co.	5	5	0
Chas. Richards and Sons, Ltd.	5	5	0
Ronson Products, Ltd.	5	5	0
J. Shaw and Son	5	5	0
Slazengers (Airworks), Ltd.	5	5	0
Standard Fireworks, Ltd.	5	5	0
Henry Williams, Ltd.	5	5	0
F. Austin, Ltd.	5	0	0
J. J. Habershon and Sons	5	0	0
H. J. Mulliner and Co.	5	0	0
M.H.H. Engineering Co., Ltd.	4	4	0
Anglo-Swiss Screw Co.	3	3	0
Bath Cabinet Makers Co., Ltd.	3	3	0
Empress Lift Co.	3	3	0
Marco Refrigerators, Ltd.	3	3	0
A. P. Lindberg and Sons	2	10	0
Brent Laboratories, Ltd.	2	2	0
Gent and Co., Ltd.	2	2	0
Grosvenor Works (Holloway), Ltd.	2	2	0
Metal Components, Ltd.	2	2	0
Meta-Phrouts	2	2	0
Mollart Engineering Co., Ltd.	2	2	0
W. Mumford	2	2	0
F. H. Pride, Ltd.	2	2	0
C. N. Smart, Ltd.	2	2	0
Smith and Ansell, Ltd.	2	2	0
The Stourbridge Rolling Mills	2	2	0
Peter Stubbs, Ltd.	2	2	0
Tickford, Ltd.	2	2	0
Wilkes, Berger Engineering Co., Ltd.	2	2	0
E. and E. Kaye, Ltd.	2	0	0
Crawford and Co.	1	1	0
Kingley Engineering Co., Ltd.	1	1	0
McMichael Radio Co.	1	1	0
J. W. Walker and Sons, Ltd.	1	1	0
	£6,975	1	7

HERE AND THERE

Bravo, Liverpool!

A TROPHY has been presented to Liverpool by the Air Ministry for raising £16,799,069 in its Wings for Victory week, this colossal sum being second only to London.

Air Vice-Marshal Sir Leonard H. Slatter made the presentation to the Lord Mayor of Liverpool, Alderman R. D. French, together with fifty log books to be allocated to aircraft associated with Liverpool, these to be returned for the city archives after the war.

From Vengeance to Havoc

PRODUCTION of the Vultee Vengeance dive-bomber at the Nashville plant of the Consolidated Vultee Aircraft Corporation is to be tapered off during the next few months in order to prepare for the production, early next year, of the Douglas A-20 Havoc.

This is yet another side-light on America's changing attitude towards the dive-bomber, the limited usefulness of which is being more and more realised in the light of operational experience.

Franco-Russian Fighter Squadron

A FIGHTING-FRENCH squadron, known as the Normandie Squadron, is operating on the Russian front under the command of a 30-year-old major who saw plenty of air fighting during the Libyan campaign.

The squadron is equipped with Russian YAK fighters, of which they are reported to speak very highly. Its pilots have a useful number of Huns to their credit, and a favourite operation is that of train and lorry busting.

Supply and Rescue

ANOTHER news item from our Russian allies says that during the past two years their guerillas have wrecked some 3,000 German aircraft "behind the enemy lines," while the guerillas themselves are being regularly supplied with ammunition, food, etc., by old U-2 single-engined biplanes, flying at night, which have returned to their own lines carrying Russian children, orphaned by the invaders.

Dihedral

AN acquaintance who knows far more about the English language than he does about aircraft or flying recently expressed disapproval of some of the terms in general use in aviation circles.

He particularly complained about the word "dihedral," which, he says, means "two plain surfaces," and is therefore wrongly used by us flying folk to indicate the upward angle of a wing from the horizontal.

As for "anhedral," the first syllable, "an," certainly means "negative," but the rest of the word is wrongly applied.

Who started this, anyway?

R.C.A.F. to Buy Helicopters

ROYAL CANADIAN AIR FORCE headquarters in Ottawa have announced that six helicopters are on order from the United States for use as rescue aircraft and also, possibly, to serve localities now dependent on irregular shipping facilities.

Their primary function as rescue aircraft will be to reach airmen who are forced down in territory which is inaccessible to any other means of transport.

There is no intention, as yet, to use them for convoy protection.

"Aussies" in the Air War

SOME impressive figures recently quoted by Mr. A. S. Drakeford, the Australian Air Minister, showed that the Commonwealth had contributed 16,000 trained aircrews, via the Empire air training scheme, up to March of this year, that the number of aircrews abroad had increased by 200 per cent. since September, 1941, and squadrons by 50 per cent.

The R.A.A.F., he disclosed, is now thirty times larger than at the start of the war, and its establishments have been multiplied by fifty.

The total R.A.A.F. casualties to date are 2,369 killed, 1,433 wounded, 982 missing, and 301 prisoners.

Canadian Aircraft Output

CANADA is now producing aircraft at the rate of eighty per week, and her aircraft industry employs more than 100,000 people, including some 25,000 women, according to a recent statement by the Hon. C. D. Howe, the Canadian Minister of Munitions and Supply.

Types now in production are the Lancaster, Mosquito, Catalina, Helldiver, Bolingbroke, Harvard, Anson, Cornell and Norseman. The last-named, which is used both as a transport and for aircrew training, is the only all-Canadian-designed aircraft in the list.

Air-mail Reminder

ALTHOUGH it has previously been stated that there is no ordinary air mail service to the British North African and West African Forces, the G.P.O. is still receiving 1s. 3d. air mail letters for these addresses.

These have to be sent by surface route and, where the name and address of the sender is given on the cover, the excess charge is refunded, which causes an enormous amount of extra work with its wastage of precious man-power.

There is, however, an air-letter service (6d.) to both North African and West African Forces, and the difference between this and an ordinary air-mail service should be noted.

The North African Force also has an Airgraph service (3d.), but this has not yet been extended to West Africa.

De Havilland Appointment

THE de Havilland Aircraft Co., Ltd., Hatfield, England, announces that Mr. P. C. Garratt, who has been vice-president and managing director of the subsidiary company, de Havilland Aircraft of Canada, Ltd., since 1936, has now been appointed to the board of directors of the parent company and will shortly take up the post of resident director in North America to look after the parent company's interests in Canada and the U.S.

Mr. J. Grant Glassco has been appointed, by the Department of Munitions and Supply, in charge of the de Havilland production organisation in Toronto on Mosquito manufacture.

You 'Eard!

LT. COL. C. S. HOUGH'S power-drive in a Lockheed Lightning at the officially reported speed of 780 m.p.h. was one of the great newspaper stories of the month and was extensively "featured" in the dailies last week.

Without comment, we reproduce the two following quotations, from interviews with the celebrated American pilot:

Daily Mail: "There was the noise of it like the roaring and rushing of a sea past my cabin and the shrill screaming of the propellers."

News Chronicle: "All I could hear was a faint engine whine, ——."

Col. Hough, who put up a marvellous performance, has our sympathy.

BLIMP BARN: Measuring more than 1,000ft. long, about 300ft. across the base, and 170ft. high, hangars for U.S. Navy blimps used on coastal submarine patrol are now being constructed entirely of wood, in pre-fabricated sections, at a cost which is about two-thirds that of steel hangars of the same size.

The Tandem Monoplane

Does it Still Have a Future? : Some Past Experiences Recalled

By THE EDITOR

THESE notes are written with no intention of reviving the old Wright-Langley controversy. The Langley tandem monoplane came to grief in the Potomac River, and, indeed, from what we now know, it could not have been a success. That subsequent flights with a much modified machine proved nothing is now admitted by the recent recantation of the claims and statements previously made by the Smithsonian Institution. The Langley "aerodrome" did not fly, and could not have flown successfully in its original form, and the Wright brothers are entitled to the full credit for the first practical flying machine.

The superimposed as distinct from the tandem-wing arrangement went from strength to strength, and it held the field almost exclusively until the cantilever monoplane drove it, for all practical purposes, from the sky. There were thin-winged braced monoplanes, to be sure, but they were always in the minority. Aerodynamically they were but little "cleaner" than the biplanes, and structurally they were less efficient.

In view of the almost instant success of the Wright brothers and their followers, it was scarcely surprising that Langley's unsuccessful tandem monoplane should inspire few experimenters. Even such early researches as those of Gustave Eiffel (whose first volume, inscribed by the author, is still one of my most treasured possessions) tended to show quite unmistakably that aerofoils in tandem were less efficient than superimposed aerofoils, and much less efficient than the single aerofoil.

Gloucester 1910

Curiously enough, my aeronautical career began with a tandem monoplane. That was before I had had an opportunity of studying any of Eiffel's works, or, indeed, any other works on aerodynamics. Towards the end of 1910 the call of the air had become too strong to be resisted, and I became apprenticed to a firm in Gloucester, who were designing and building not only flying machines but engines to drive them.

We knew little of aerodynamic science and not much more about structural strength calculations, but hoped that enthusiasm and common sense would carry us through. They might have done so had available finances been greater. As it was, the failure to achieve immediate success caused the firm, an old general engineering concern, to close down.

Just what caused the designers, two brothers Scott, to choose the tandem-wing arrangement I do not quite know. I think it was expressed somewhat vaguely and crudely in the argument that if the weight was carried between two wings in tandem, the machine would not have to be balanced "on a knife edge," as was the more orthodox type. That sounded feasible enough; we had no chance to prove it, since the machine never left the ground, due to lack of power in the little rotary engine designed and built for it.

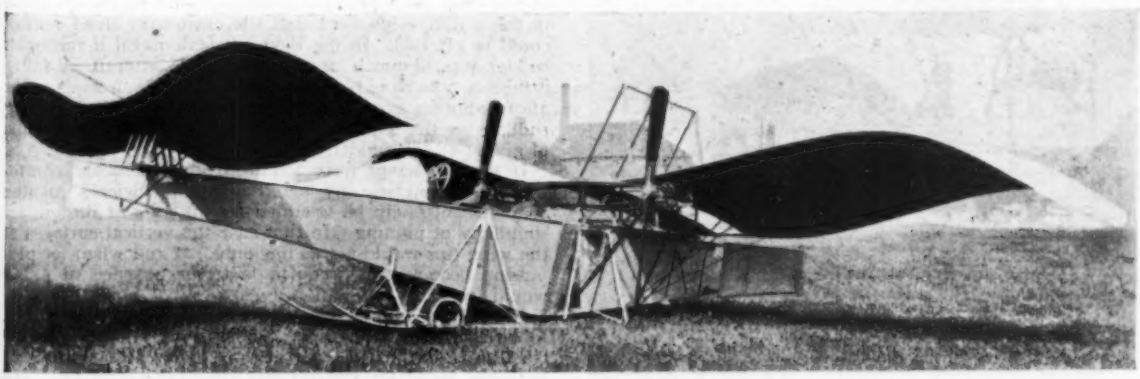
Chain-driven Airscrews

The engine was mounted between double bearers in the centre of a triangular-section fuselage. There was chain transmission to two airscrews carried outboard, on outriggers, ahead of the rear wing. One chain was crossed as in the Wright biplanes so as to obtain contra rotation of the airscrews. Directional control was by two rudders just aft of the rear wing. Elevator control was effected by tilting the whole of the front wing. Although this wing was hinged at the point where we thought the centre of pressure would normally be, it might well have proved a handful for the pilot, since the control was not irreversible.

As in nearly all aircraft of that period, lateral control was by warping the wing. Only the rear wing was arranged to warp, so that it would have had to overcome any natural lateral stability the front wing might have.

Not content with having a low centre of gravity, we gave the wings a large dihedral in the centre and a negative dihedral at the tips—a sort of "gull's wing," in fact. Just what would have been the effect of the down-turned tips of the rear wing when it was heavily warped is a matter for speculation. There would probably have been a rudder effect which might have caused surprises. The object of the gull's wing formation was to secure lateral stability, and, to give an idea of the extent to which flying machines were not understood in those days, I may perhaps be permitted to quote an instance. A prominent business man had been shown over the machine for quite a long time, and had had its features explained to him. He pondered deeply, and then, pointing to the two airscrews, said: "I think your machine should be very stable; you have got those two paddles to keep it balanced"!

Tandem monoplanes died in England with this Gloucester effort of 1910-11. At any rate I cannot recall any serious effort that followed. There was one at an Olympia show which was somewhat on tandem lines, but nothing



TANDEM MONOPLANE OF 1910-11: The machine, built by Webb, Peet and Co., of Gloucester, had "gull's wings," contra-rotating airscrews, tricycle undercarriage—and didn't fly!

D

THE TANDEM MONOPLANE

more was heard of it. It was not until the Itford glider meeting of 1922 that we saw a tandem monoplane in the air. This was the little single-seater glider designed and built by the Frenchman Peyret and flown by his compatriot Maneyrol to such good effect that it won the prize.

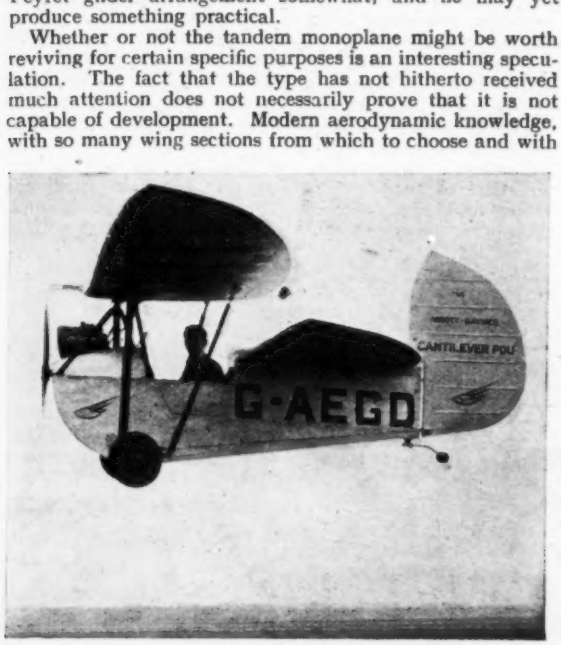
Louis Peyret's effort was in fact a very creditable one. The two wings were of the same area, and as the pilot sat by the trailing edge of the front wing, the weight distribution was probably reasonably correct. Front and rear wings had ailerons, and the control was so arranged that the four flaps worked together, front and rear wing flaps in opposition for elevator effect, and in unison for aileron control. Maneyrol, when he finally did get into the air on the last day of the meeting, remained aloft for 3 hours 21 minutes, and proved that the tandem Peyret had one thing which all the other gliders lacked: controllability. The aerodynamic efficiency was much inferior to that of the high-aspect ratio orthodox gliders, but the controllability did enable the pilot to keep the machine in the up-currents and thus to "sit" for as long as the wind lasted.

Not Followed-up

After the Peyret-Maneyrol success it might have been expected that someone would have attempted to apply the tandem-wing principle to power-driven aircraft. No one appears to have done so. The reason probably was that in those days, when we thought of light aircraft, we thought in terms of very small engines, motor cycle engines, in fact, as was shown the following years at the Lympne light aircraft trials. The tandem wing was believed to be so inefficient as to be ruled out for aircraft that had to fly with a minimum of power.

One somewhat abortive attempt was made by the French designer Henri Mignet with his "Pou-du-Ciel." That little machine was by way of being a tandem monoplane, but the overlap of the two wings placed it somewhere between the tandem and the biplane, and the "slot effect" was so pronounced that it tended to swamp the tandem characteristics. Mignet did effect a cure of the vices of the original machine by fitting both wings with flaps, thus approaching the Peyret glider arrangement somewhat, and he may yet produce something practical.

Whether or not the tandem monoplane might be worth reviving for certain specific purposes is an interesting speculation. The fact that the type has not hitherto received much attention does not necessarily prove that it is not capable of development. Modern aerodynamic knowledge, with so many wing sections from which to choose and with very effective flap arrangements capable of application, might put a very different complexion on the whole matter.



Mignet's "Pou-du-Ciel" was not truly a tandem monoplane, the slot effect being predominant.

Maneyrol on the Peyret glider setting up a record of 3 hr. 21 min. 7 sec at Firle Beacon in 1922. Both wings had flaps, interconnected to operate as elevators and ailerons. The rudder was probably ineffective.

I have referred to the somewhat vague notions we had in 1910 of the advantage of the tandem-wing arrangement. There is little doubt, however, that the location of the centre of gravity is rather less critical than is the case with the orthodox monoplane. Its movement fore and aft, unless carried to extremes, should do little more than vary the proportion of load carried by the two wings, a matter which could probably be taken care of by a small change in the front-wing incidence. The speed range might be slightly reduced, due to the fact that the rear wing is never permitted to reach maximum lift before the front wing stalls. To offset that, both wings are lifting and there is no tail to produce a down-load.

Basically there is, of course, some similarity between the tandem monoplane and the tail-first machine. It is mainly a question of the relative size of the two wings. In the tail-first the front wing is "elevator size," but if it grows a point is reached where it is difficult to say whether the machine is tail-first or tandem. Both share the fundamental condition that for longitudinal stability the front wing must be more heavily loaded than the rear, and, if the wings have the same section, must be flying at a greater angle of incidence. Then the front wing, or front elevator in the tail-first, will stall before the other. In the tail-first type that should make spinning impossible, since the rear or main wing is never permitted to reach stalling angle.

With the tandem-wing arrangement the front wing, when stalled, might have a tendency to spin. This, presumably, would be resisted by the rear unstalled wing, and the two would have to "fight it out" between them.

Directional control and stability are something of a problem with the tail-first, the tailless and the tandem wing arrangements. With tandem wings, however, it would appear that such powerful controls could be incorporated in the trailing-edge flaps that the customary third control could be omitted. In the Peyret it is doubtful if the small rudder was of much use. Two-control aircraft of fairly orthodox type have been built, and the tandem wing might afford another avenue of approach to that subject. Drag rudders on the wing tips should, in any case, be capable of giving all the rudder control necessary.

If tandem wings were found to give adequate control without a rudder, any aerodynamic inefficiency of the arrangement might be tolerated for the sake of the greater simplicity of piloting. In that case the vertical surfaces at the wing tips would act as fins only. If and when jet propulsion becomes an accepted fact, the absence of a tail would facilitate installation.

For certain military purposes there might be a good deal to be said for wings in tandem, especially in the smaller classes of aircraft. A twin-engined two-seater fighter, for example, could, by suitable location of the main loads, be given an excellent field of fire for the rear gunner and an unobstructed view for the pilot.

C. M. P.

Reflections

The Work of the Rotol Flight Test Department

By BRYAN GREENSTED
(Chief Test Pilot)

MR. GREENSTED has been responsible for the flight-testing of Rotol airscrews since the company first decided to establish such a department. That his work has played an important part in the remarkable development which lies between the spring of 1939 and the present time goes without saying. His whimsical review of that four-year period is written in a style which will appeal greatly to readers.

The author and one of his "milestones"—the four-blader.

WHEN seated in a comfortable chair in a well-heated office, and armed with the knowledge that not only are all the aircraft unserviceable but the Cotswolds are covered with impenetrable fog, I am not averse to quiet reflection. In fact, I am definitely given to it.

My reflections range from beer to Barracudas, income tax, fillet steak (with French fried and mushrooms, of course), and to places away beyond the hills of Idaho. It is not altogether surprising, therefore, that I should occasionally review, mentally and at my leisure, the work of the Rotol Flight Test Department since it was formed in May, 1939.

As I sit here reflecting like anything, what strikes me most is that we seem just at this moment to have arrived at a milestone in the development-flying of airscrews. Milestone is, perhaps, not a very fortunate choice of word, since even the most prejudiced have not yet got around to describing the contra-rotating airscrew as a piece of masonry. However, let me explain.

When the Department flew its first aircraft for the first time, that aircraft was a Gloster Gauntlet fitted with a three-bladed adjustable-pitch metal airscrew. Since that day we have been through the whole range of airscrews—from two blades to as many as we can put into a single hub, constant-speed and feathering—and we are now flying the six-blade contra-rotating, constant-speed airscrew for engines of over 2,000 h.p.

It appears, then, that although the airscrew is now split into two counter-rotating halves, and its speed is governed by a constant-speed unit, we are back at the beginning again with two three-blade airscrews instead of one, and are being confronted with all the problems of efficient contra-rotation.

Sticky Flying

The adjustable-pitch airscrews on the Gauntlet were used for paint adhesion tests; it took no more active part in our saga of airscrew development than that. The tests, however, resulted in a drastic re-orientation of our carefully matured attitudes towards flying in bad weather since one of the requirements was that the flying should be carried out under the most adverse flying conditions possible in order to subject the blades to a very severe test.

Altogether, with various airscrews and various tests, we flew about 300 hours in rain, hail, snow and sleet. The replacing of the Gauntlet by a Gladiator set an interesting and, so far, insoluble problem. Would you rather be wet over a large area by a spray of constant density, or wet over a small area (eye, left foot, ear, etc.), by one of those high-velocity, high-capacity jets which seem always to find their way through the cracks between hood and windscreen? (If I appear to digress, you must remember I am reflecting, and that we may at any moment talk about the hills of Idaho aforementioned.)

The flying development of the various constant-speed airscrews has been continuous and progressive, with the exception of the two-bladed C.S. feathering type, which was flown after the four-blader. As they are naturally intended only for comparatively small engine powers and therefore presented under test none of the operational difficulties of modern Service types, the continuity of testing of the larger sizes was not affected; and each type, whilst presenting its own peculiar problems, has added to that store of knowledge which has been applied to the next stage of development.

At the same time as these basic types of bomber and fighter airscrews were undergoing vigorous endurance, performance and operating tests, all sorts of special investigations were being carried out. These included such items as hydraulic pitch locks; devices to prevent over-speeding; suitability and simplification of controls; de-icing and a hundred-and-one other refinements which are still officially "off the record." Nor must I forget all the intensive development carried out with our electric airscrews, which series of tests formed a programme of their own. In fact, when I review them all, and remember also that we have flown approximately 5,000 hours since the beginning of the war, I begin to feel that, though I sit in a comfortable chair at this moment, there must have been times when we have been fairly busy.

The New Phase

It is therefore all the more pleasant to feel that we have now started a new (and more complicated?) phase of airscrew development: flying with an airscrew which contributes largely to the ease and comfort of the pilot. I have always resented the necessity of preventing those violent swings which are associated with the throttle movements of our hitherto conventional engines—swings which threaten to convert a correctly executed turn into a sideslip, merely because the pilot wishes to throttle back during his circuit.

I also resent the efforts of high-powered aircraft to make sudden dashes off the runway during the take-off. They have caused me many anxious moments. Nor do I like the feeling of putting one wing down during the take-off, particularly when this attitude is associated with a strong adverse cross-wind and a narrow-track undercarriage. Again, during the take-off, I object to the feeling of the aircraft skating along on the outside edge of one tyre. (You haven't considered that the cancellation of torque equalises the load on the tyre, thereby reducing the wear, have you? Don't tell the salvage authorities.)

The contra-rotating airscrew, therefore, finds me a very willing admirer. If we could go back again to May, 1939, armed with our present knowledge of the behaviour of the

(Continued at foot of next page)

The Empire and the Air Age

"It is Said That England Likes a Challenge" : Here it is : Without Post-war Air Transport Parity the Empire Cannot Survive

By W. HUDSON FYSH, D.F.C.

THE place in the sun which is held to-day by British service types of aircraft has never been more advantageous nor, in fact, sunnier; but this is not so in regard to air transport types. The reason for our inferiority is not due to any deficiency during the war, when fighter and bomber production made the highest strategical demands, but to an extraordinary between-war period lasting 20 years when the United Kingdom fell to a weak position from an air transport point of view in relation to the Empire.

It is said that the Britisher is good at coming from behind and winning when things are at their glummest. It is said that England likes a challenge.

Well, here it is! Without post-war air transport parity with the world's best, the Empire cannot survive as such in the coming era of air domination, and without the Empire—those red patches on the map—England's greatness would vanish, and her power as a leader of world stability and as a striver for peace would disappear.

British air parity, in the first instance, must flow from the production of truly competitive air transport aircraft, just as British leadership in the past flowed from her skill as a builder of ships; first, in the old sailing ship days, then in the days of steam, and from machinery, excellent steam locomotives, and so on. Competition on the sea is passing to the air; and therefore on the decisions that are made to-day and in the near future will greatly depend the future of the Empire.

How can this be attained? Was there a specification in producing the Spitfire, Hurricane, Mosquito, the Lancaster and the Halifax, which can be followed out in producing the required air transport types? What was the magic secret of success which might be applied to the production of air transport?

Never were the stakes higher. Canada, Australia, India, New Zealand, South Africa are as chips on the gaming table, and on the collective group is written "Empire." Old John Bull has just taken his seat and is very thoughtfully getting ready to play on the ace lead from across the table.

In reality, John Bull and Uncle Sam are playing a game for customers for their post-war aircraft industry and more. Competition there must be, but all true friends of Democracy at the same time look for the true partnership of these two great world powers in securing world peace and concord and enlightened advancement of the world's peoples. Now, if the further maintenance of the British Empire seems a good thing, and one which will assist towards that world stability and peace (and it surely cannot be denied that the British, with their cautious outlook on change and innovation, with their age-tried institutions and their fund of knowledge, are in actuality the world's greatest stabilising factor), then their presence is necessary, and an indisputable essential for that proper presence is air transport parity.

THE author is managing director of Australia's great air transport company: Queensland and Northern Territory Aerial Services, Ltd., better known under the abbreviation QANTAS. He has been on a visit to this country and has done his best to impress upon all concerned the need for strong Empire air communications.

Here Mr. Hudson Fysh pleads for a true partnership between the United States of America and the British Empire. He points out that the Empire can only play its part worthily if it is given that essential pre-requisite: air parity.

YOUTH AND AVIATION

A PROPOSAL aimed at outlining the part our young men should play in building up post-war aviation has been drawn up and submitted to a number of influential people by Sir Bertram H. Jones, K.B.E., and Councillor W. J. Taylor, O.B.E., D.L. Sir Bertram is chairman of the Chairmen's Advisory Committee of the Air Training Corps, and Mr. Taylor is chairman of the Yorkshire Air Training Corps Association.

The memorandum suggests the formation of a British Air Corps and expresses the hope that similar corps may be established in various parts of the Empire. Eventually these separate bodies might be fused into one great British Empire Air Corps.

Three divisions are suggested: a senior division in which ex-Service personnel would be admitted; a junior division for giving youths pre-entry training for civil aviation careers; and a preparatory division allied to and working with the existing Air Scout organisation.

Such corps would, it is believed, ensure the availability of large numbers of skilled personnel to man an Air Police Force, Marine Air Patrols, and an Air Territorial Force. For the latter the title British Empire Air Reserve is suggested.

The suggestion is that, although the organisation must be attached to a Government Ministry for purposes of Parliamentary control of financial assistance, it should be administered by a civilian board. It would be financed partly by Government grants and partly by funds which it is believed would be readily forthcoming from the aircraft and shipping industries.

REFLECTIONS (*Continued from previous page*)

different types of airscrew, I would cause never-ending production crises by advocating that all airscrews should be reduced to a contra-rotating form.

All this is the more interesting since we have so far flown a contra-rotating airscrew only with the object of proving the mechanism and not with any idea of absorbing the engine power more efficiently. Comparative performance figures have been taken elsewhere but are not for publication. My impression of the airscrew is obtained purely from handling characteristics and is not influenced by any claims of superlative improvements in performance.

I am therefore feeling smugly content that these testing phases should close and open with such a personally satisfactory airscrew, and I can look forward to its future development. And when, in an unspecified number of years' time, I have flown the multi-blade, contra-rotating, feathering and reversing airscrew, with its single-lever power control, I'll do some more reflecting. In the meantime—excuse me, I can hear the hangar doors being opened.

High-performance Fighters

Summary of an Article by Kurt Tank

THE author, who is the designer of the well-known FW 190 fighter, briefly enumerates desirable qualities of such aircraft: maximum possible horizontal speed at all altitudes, very high rate of climb and ceiling, highest possible diving speed, excellent manœuvrability. All these desirable features should be combined in the smallest and lightest possible aircraft capable of housing the pilot and power plant together with such essential equipment as fuel and armament.

It is well known that it is impossible to incorporate optimum values for all these qualities in one and the same design. Thus high horizontal speed and high rate of climb necessarily involve differences in wing loading if optimum values are to be reached with a given power plant. At very high altitudes an increase in aspect ratio is beneficial whilst manœuvrability generally goes with a small wing span.

Till quite recently, horizontal speed was given primary consideration. Every increase in output of power plant was utilised for this purpose, and the relatively poor rate of climb was accepted as a necessary price. Wing loadings were pushed to the limit, rendering take-off and landing relatively difficult.

Height-speed Compromise

With the advent of the high-altitude bomber, the need for a higher rate of climb for the fighter has become urgent. Combats are taking place at ever-increasing altitude, and the aircraft with the higher ceiling has a very important advantage. Whilst before everything was sacrificed for speed at relatively low altitude, modern fighter design calls for a very careful compromise, unless, as is sometimes suggested, two separate fighter designs are developed.

The author has investigated this problem very fully and concludes that with careful design optimum rate of climb and ceiling can be achieved for only a relatively small sacrifice in maximum horizontal speed amounting to about 27 km/hr. and 54 km/hr. at supercharged heights of 6,000 m. and 12,000 m. respectively.

On the other hand, the more lightly loaded aircraft has the advantage of 1,700 m. in ceiling and 3.7 m/sec. in rate of climb. As a matter of fact, the sacrifice in horizontal speed is likely to be less than 54 km/hr., since the calculation neglects compressibility effects. (Such effects will be more pronounced for the heavily loaded aircraft flying at the greater incidence.)

It is thus clear that for operation between 6,000 m. and 12,000 m. the fighter should be designed primarily for maximum rate of climb and the wing loading should not exceed about 150 kg/m².

Adequate strength of the structure is of primary importance, since compressibility effects may produce sudden changes in load distribution, especially during a high-speed dive. This may not only reduce the effectiveness of the control surfaces but may actually lead to destruction of the wing. Several fatal accidents are attributed to this effect.

Compressibility Effects

Modern physiological research has shown that under suitable conditions the pilot can withstand, for a short period, accelerations in excess to those corresponding to the standard load factors. There is thus every inducement to increase the strength characteristics of modern designs, and thus also allow for high-speed compressibility effects.

In conclusion the author makes a plea for restricting the weight of equipment to the utmost. At 10,000 m. an increase of one per cent. in the dead weight of the aircraft will reduce the ceiling by about 65 m., whilst an increase of one per cent. in the h.p. will increase the ceiling by only 43 m. Unfortunately, the high-altitude operation necessitates extra equipment, such as oxygen for the pilot and heating for the guns. The power plant also becomes heavier, due to increased size of supercharger and airscrew.

The problem calls for considerable ingenuity on the part of the designer, and considerably more research on the flying qualities of aircraft at high altitude is required before the element of "luck" can be considered as ruled out in the final compromise solution.

[*Flight* is indebted to R. T. P., Ministry of Aircraft Production, for the translation from the original in *Luftwissen*.—ED.]

AIR COMMODORE A. H. ORLEBAR, C.B.E., A.F.C. and Bar

THE death in hospital of Augustus Henry Orlebar, Deputy Chief of Combined Operations, will be very widely regretted. Rugby, the Bedfordshire Regiment, Gallipoli, No. 73 Squadron, R.F.C., test pilot at Martlesham, the R.A.F. Staff College, O.C. the High Speed Flight, holder of the world's speed record, the Imperial Defence College, Assistant Chief of the Air Staff, that in brief is an outline of "Orley's" career. To that should be added that he was wounded at Gallipoli and again in air combat in the last war.

Air Comdre. Orlebar

But to many of the public and to air correspondents, Orlebar will go down to history as the ideal commander of the High Speed Flight which won the Schneider Trophy for Britain in 1929 and 1931, and secured the trophy as a permanent possession of the Royal Aero Club of the United Kingdom. It was a job which required leadership and tact in abundance, and Orlebar was pre-eminent in both these respects. He never contemplated allowing himself the pleasure and honour of flying in a Schneider race, but he always tested every new racing seaplane himself before handing it over to his pilots, and his influence kept his team of pilots and aircraftmen working wholeheartedly without friction at a time when nerves must have been highly strained. After the 1929 contest was over, he allowed himself to set up a world's speed record. He well deserved that distinction, though it was afterwards beaten by his friend the late George Stainforth, and still later by the Italian, Agello.

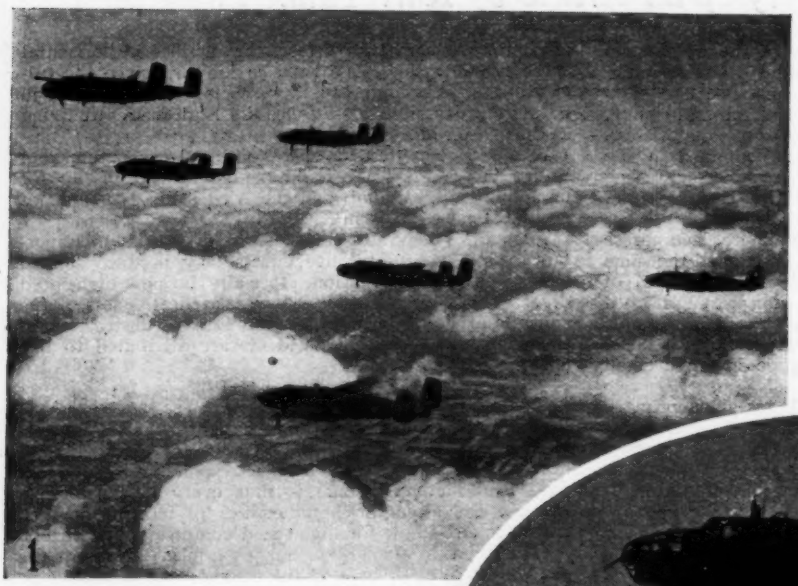
VICTORY DELAYED

AFTER six weeks spent in a Midlands bomber factory, Dame Laura Knight, R.A., one of Britain's most distinguished painters, has completed a picture intended to show, in highly dramatic fashion, what the menace of carelessness means to our war production. It is called "Victory Delayed."

The suggestion that Dame Laura should paint such a picture came from the Minister of Aircraft Production, Sir Stafford Cripps, who keeps the problem of combating factory fires constantly in mind, and the idea that most appealed to her was that of painting an imaginary fire in a bomber factory. It was to be the sort of fire that begins through the unthinking negligence of some person who has thrown away a lighted cigarette-end or match.

In a few weeks' time the picture that Dame Laura painted will be displayed in poster form in every British factory which is engaged on vital war production. It shows the half-completed tail end of a bomber enveloped in flames, and factory workers struggling to escape.

N.A. Mitchells in th



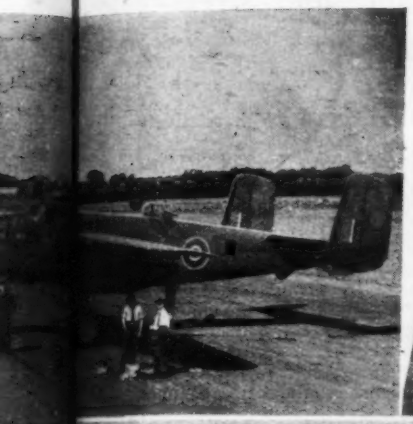
1. Above the clouds with half a dozen Mitchells. Any Fw 190 making a beam or stern attack would fly into a nest of 0.5in. guns in power-operated Bendix turrets.

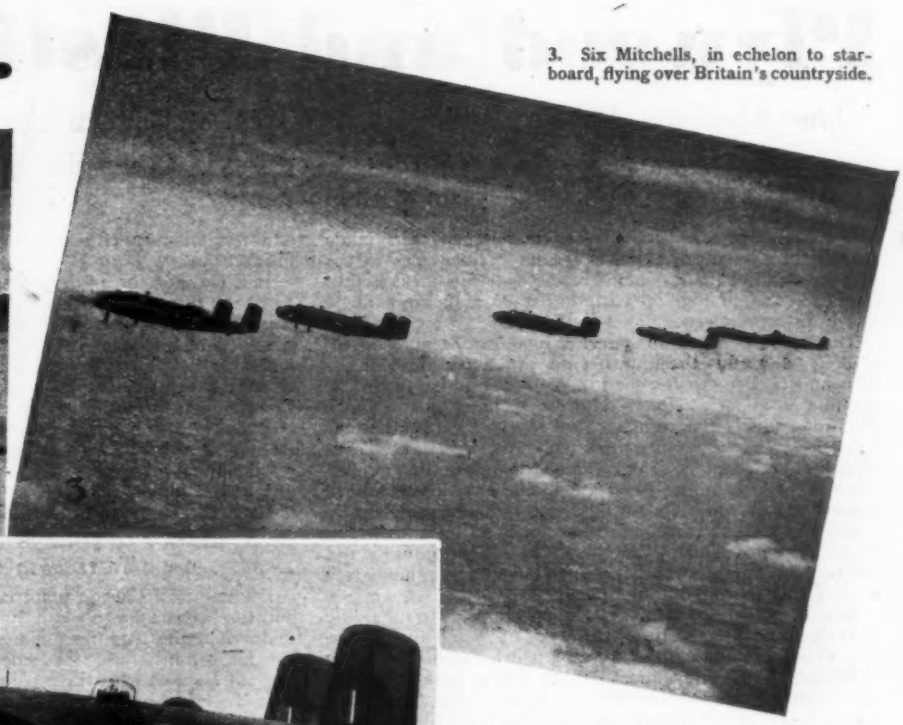
2. Normally kept at their dispersal points, these Mitchells are lined up for photographs.

"Flight" Photographs of a Squadron of North American B25s Somewhere in Britain

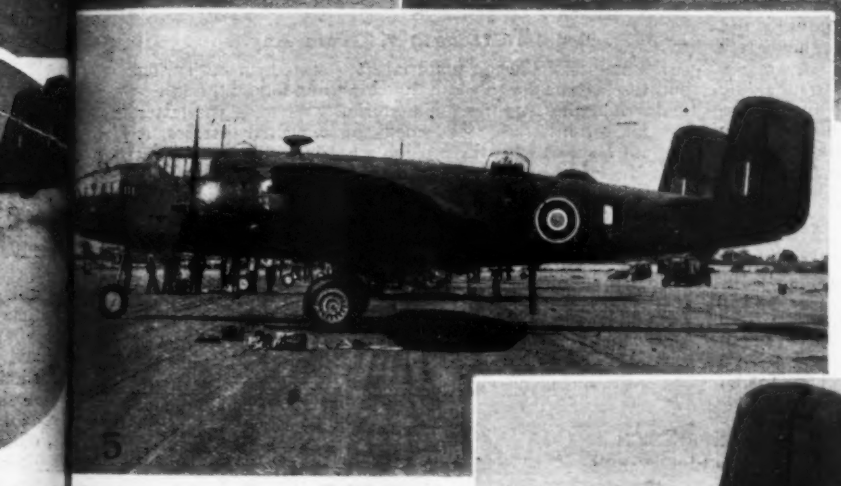
6. A fine photographic study of the B 25. The machine is thrown into relief by the haze.

he R.A.F.



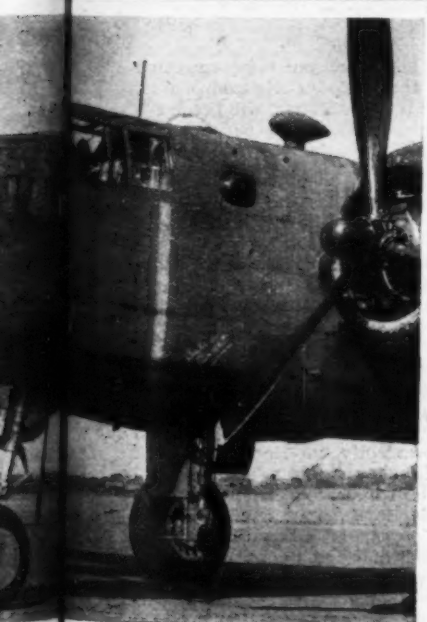


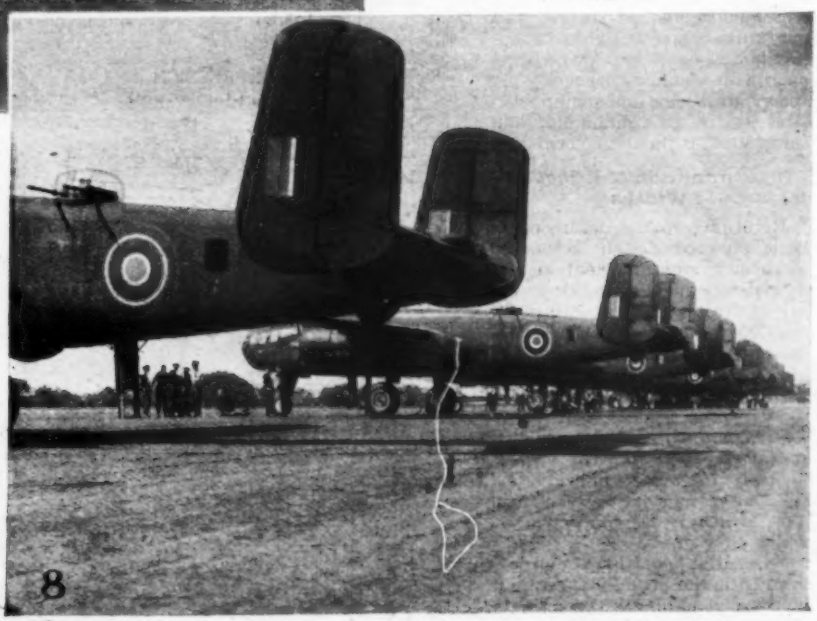
3. Six Mitchells, in echelon to starboard, flying over Britain's countryside.



4. Close-up of two Mitchells above the clouds. The gimbal mounted 0.5in. front gun hangs ready for immediate use in case of head-on attack.

5. A side view shows how a bomb-aimer's panel, a good view for the pilot, an astrodome a D.F. aerial, and a two-gun turret can spoil what might otherwise be a perfect stream-lined form.





7. Three trips already to its credit. This close-up shows the disposition of the navigator's and pilot's cockpits. Unlike the Boston there is a communicating crawlway between the cockpits for use in an emergency. The door of the hatch (seen hanging down) automatically forms a step ladder as it opens.

8. Tails up. A most right and proper picture of any squadron of the Royal Air Force whether they fly N.A. B 25 Mitchells or any other aircraft.

Plywood and Plastics—IV

The Moulded Plywood Fuselage, Effect of Grain Angle and Stress Analysis : Modern Developments

By W. NICHOLS, A.R.Ae.S.

IN concluding the previous article reference was made to tests on plywood with various grain angles to the direction of load, demonstrating that the effect is pronounced, and in Fig. 20 variation of E with grain angle has been reproduced.

The background of this curve is a series of tests at grain angle 45 deg. plus the known values of E for grain angles at 0 and 90 deg. to the load. The curve is based on the formula as given which, in addition to meeting the above requirements, is recurrent.

With the moulded plywood technique a balanced construction becomes necessary, due to the different characteristics across and along the grain directions. By balanced construction is meant that the veneers are symmetrically located in respect to thickness, grain direction and species about the centre line of the panel. If this procedure is not followed, warping of the panels will be evident immediately upon removal from the autoclave.

The operation of arranging the veneers prior to moulding is commonly referred to as the " lay-up," and by the use of thin veneers and careful lay-up a panel that is practically isotropic may be developed. With forces parallel to the grain the lay-up causes a decrease in allowable tensile and compressive values from the plain wood but increases greatly the shear allowables.

In practice a predominating stress usually occurs at a certain section, and the veneers can be arranged in the most desirable manner to accommodate this stress. In the design of the main-plane for example, it can be arranged to have high predominating grain direction on top and bottom skins where tension and compression stresses due to bending are the major considerations. Approaching the neutral axis, longitudinal or spanwise grained veneers can be tapered out until a lay-up exists of approximately as many spanwise as chordwise grained veneers. At this point tension and compression stresses are at a minimum and shear stress is the design criterion.

Determination of Effective Widths

Returning to the discussion of basic plywood design factors by Marhoefer, stress calculations for a typical fuselage section are briefly dealt with. As with metal monocoque practice, the determination of the proper width of plate to include with the stiffeners (" effective " widths) in calculating section properties arises. A typical section through a fuselage shell is shown in Fig. 21 with various " effective " widths indicated on the compression side of the neutral axis, which is the only one on which they apply.

" Effective " width will not only vary with the stringer stress, but will also require evaluation of the effect of the curvature of the panel (r/t). Error introduced by improper " effective " width is minimised where the grain angle of the shell is approximately at 45 deg., since En/E is then quite low and renders any chosen value of shell width relatively insignificant.

It is claimed for 45 deg. veneers that values of " w " = 12/t each side of the stiffener plus the skin over the stiffener itself have given reasonably good results in practice. The moulded monocoque shell without structural frames, etc., has inherently a rigidity not found in sheet metal construction, and such rigidity has a decided supporting effect upon the stringers. This is borne out by the tendency of the compressive stringers under tests to carry loads beyond those that would normally be anticipated.

Likelihood of the skin buckling under load is greater, due to the higher shear stress encountered in the vicinity of the neutral axis, and the problem as to the correct amount of " effective " width is reduced.

Tensile Strength v. Grain Angle

Behaviour of tension material, it is stated, in both wing and fuselage has been more difficult to understand and explain than the compression material. Whereas the latter has almost invariably exceeded the expected stresses, it has not been so with the tension material. The possibility that the effect of grain angle may be the source of trouble has led to investigations of tensile strength variation with grain angle. Results of such investigations are presented in the curve, Tensile Strength v Grain Angle, shown in Fig. 22. Actual values have been reduced to a function of the standard tensile strength parallel to the grain to facilitate use with various woods. Tests for this curve were obtained from mahogany specimens with grain angles at 30, 45 and 60 deg. It will be noted that this curve matches closely the formula for effective modulus of elasticity.

Considering some of the stresses on the section illustrated, and assuming a bending moment of 250 000 lb.-in., the tension stress on the skin item Jp will be—

$$F^1 = \frac{My}{I} = 250{,}000 \times \frac{16.78}{1{,}504}$$

$= 2{,}780$ lb./sq. in.

This value must be corrected for the value of K, from curve, and the actual stress will become—

$F^1 = 2780 \times .23 = 640$ lb./sq. in.

Examining next the stress in stringer D—

$$F = \frac{250{,}000 \times 13.18}{1{,}504}$$

$= 2190$ lb./sq. in.

For this stress the stringer appears oversized, but it is stated that tension stresses achieved under static test do not agree. Failures in early structures in all cases except one were tension failures, which produced the basic information presented herewith in the curves shown in Figs. 20 and 22 respectively. Recalculations of sections at points of structural failure indicated that even these reductions were not sufficient, and at present an arbitrary maximum value of 5,000 lb./sq. in. tension stress is used in combination with the calculation of section properties. The author admits that the

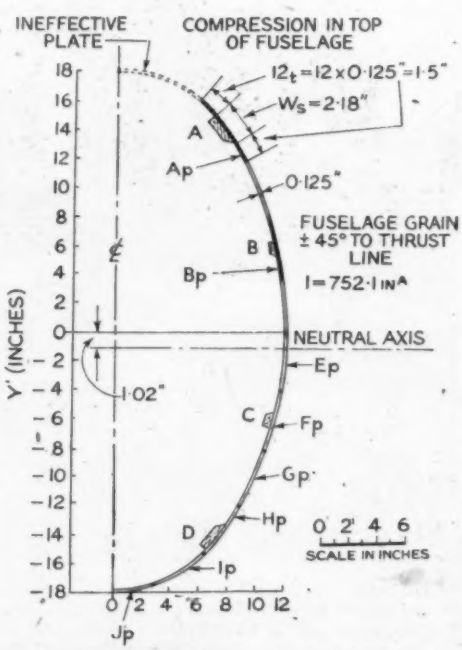


Fig. 21 Stress diagram : Section through fuselage sheet.

PLYWOOD AND PLASTICS—IV

method is full of arbitrations, and not thoroughly checked by test, but it has the advantage of predicting failures within + 10 per cent.

The maximum shear stress which the section may be expected to develop will occur at the neutral axis, since the shell is of uniform thickness. Shear at any point may be computed from :—

$fs = \frac{SQ}{bI}$ = Shear stress lb/sq. in

where

fs = Transverse shear on the section

Q = Static moment of the area above the point about the neutral axis

b = Shell thickness

I = Section moment of inertia

For the panel at the neutral axis this becomes, with an assumed shear of 2,000 lb.—

$Q = 2 \times 28.2 = 56.4$

$b = 2 \times .125\text{in.} = .25\text{in.}$

$I = 1{,}504$

$$f = \frac{2{,}000 \times 56.4}{.25 \times 1{,}504} = 300 \text{ lb./sq. in.}$$

Determination of the permissible shear load on the panel also requires a consideration of the grain direction. Normal construction would involve the grain arrangement as illustrated. Due to the size of this panel it may be assumed that the compression veneers will buckle out of action and therefore all the shear will be carried by the diagonal tension fibres.

whence F diag. = S panel/$t_e h \sin 45 \cos 45$

where t = Tension grain thickness

$$\text{S panel} = f \times 2 \times \frac{t}{te}$$

For 3-ply construction $t/te = \frac{3}{1}$

whence F diag. $= 3 \times 2 \times f = 6 \times 300 = 1{,}800$ lb./sq. in.

It is not possible in the space available to enter more fully into this analysis, and though few data have been presented upon which strength conclusion can be based, the magnitude and complexity of the subject have to some extent been indicated.

A Recent Development

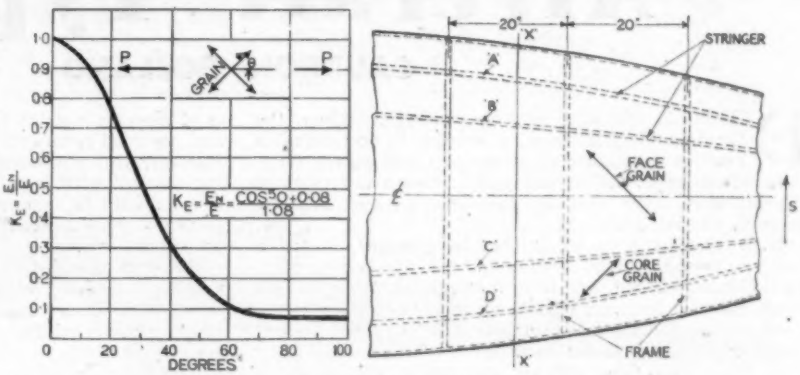
The structural design at present is inextricably involved with static tests, and the complete and authoritative check of the structural integrity must, therefore, be based upon such initial tests.

Amongst other principles that are being developed may be mentioned the latest Plasti-Ply process, which incorporates all the advantages of moulded plywood construction but involves an integral girder or geodetic structure.

Complete aircraft or component parts may be moulded by this process similarly to those described, but the "lay-up" in this case is previously carried out with "strip" veneer upon a template of the unit developed in a flat form for convenience in production. The wood veneer is reinforced with a metallic material during the plastic process, resulting in the final material becoming more or less isotropic. This fact, in conjunction with the girder principle of construction involved, permits of a relatively simple yet reliable stress analysis being made. From the production angle it appears that the fabrication costs have been reduced to an absolute minimum.

In converting from metal to wood construction, experience has shown that such parts, if properly designed, should in most cases be lighter than metal structures and possess superior stiffness. Material cost is comparable to that of metal, but as to fabrication costs of plywood structures in quantity production, little information is yet available, for such production has only recently been attempted. A new technique reducing labour costs has been devised, and there is every reason to believe that it will at least compare favourably with other methods.

In the post-war era resin-bonded plywood should certainly become a basic material, for its precise limits and capabilities are already becoming well known. Developing from a temporary substitute in wartime, such construction promises to become a serious competitor in the manufacture of certain types of post-war commercial and civil aircraft and a wide range of component parts generally.



* Fig. 20. Variation of modulus of elasticity with grain angle.

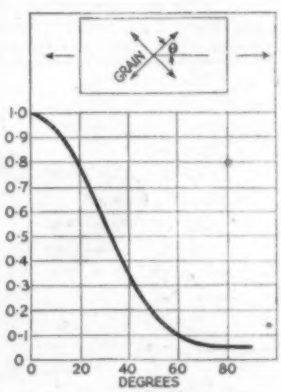


*Fig. 22. Variation of tensile strength with grain angle.

* *Plywood and Plastics—III. Due to an unfortunate error Fig. 22 was published as Fig. 20 in last issue. They both appear herewith numerically correct.*

COASTAL COMMAND'S OPERATIONS MAP

WHEN Coastal Command, in close co-operation with the Royal Navy, was planning its battle against the U-boat and enemy shipping nearly four years ago, its area of operations was comparatively small—a few hundred miles at the most from the coasts of Britain. To-day, the Command's aircraft patrol more than ten million square miles of sea, and in general the air war against the U-boat has been extended to embrace the whole of the North Atlantic ocean.

In the operations room at Coastal Command headquarters it was found that the large "situation" map had become inadequate. The Command map officer, Captain J. H. Adam, of the Royal Engineers, was therefore called in to draft a new operations map, as it is the geographical section of the general staff that draws up and supplies maps and charts for the R.A.F. as well as for the Army.

Aided by W.A.A.F. map clerks, Captain Adam laid out a new map, which was approved by the Air Officer-Commanding-in-Chief of Coastal Command, and work on its construction was begun. Scaffolding was erected, and, working in day and night shifts, R.A.F. cartographical draughtsmen soon completed the chart. This new map, a picture of which is on page 184, is 20 feet by 30 feet, and is one of the largest yet made on a conical projection.

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Aircraft Types and

CAUDRON GOÉLAND

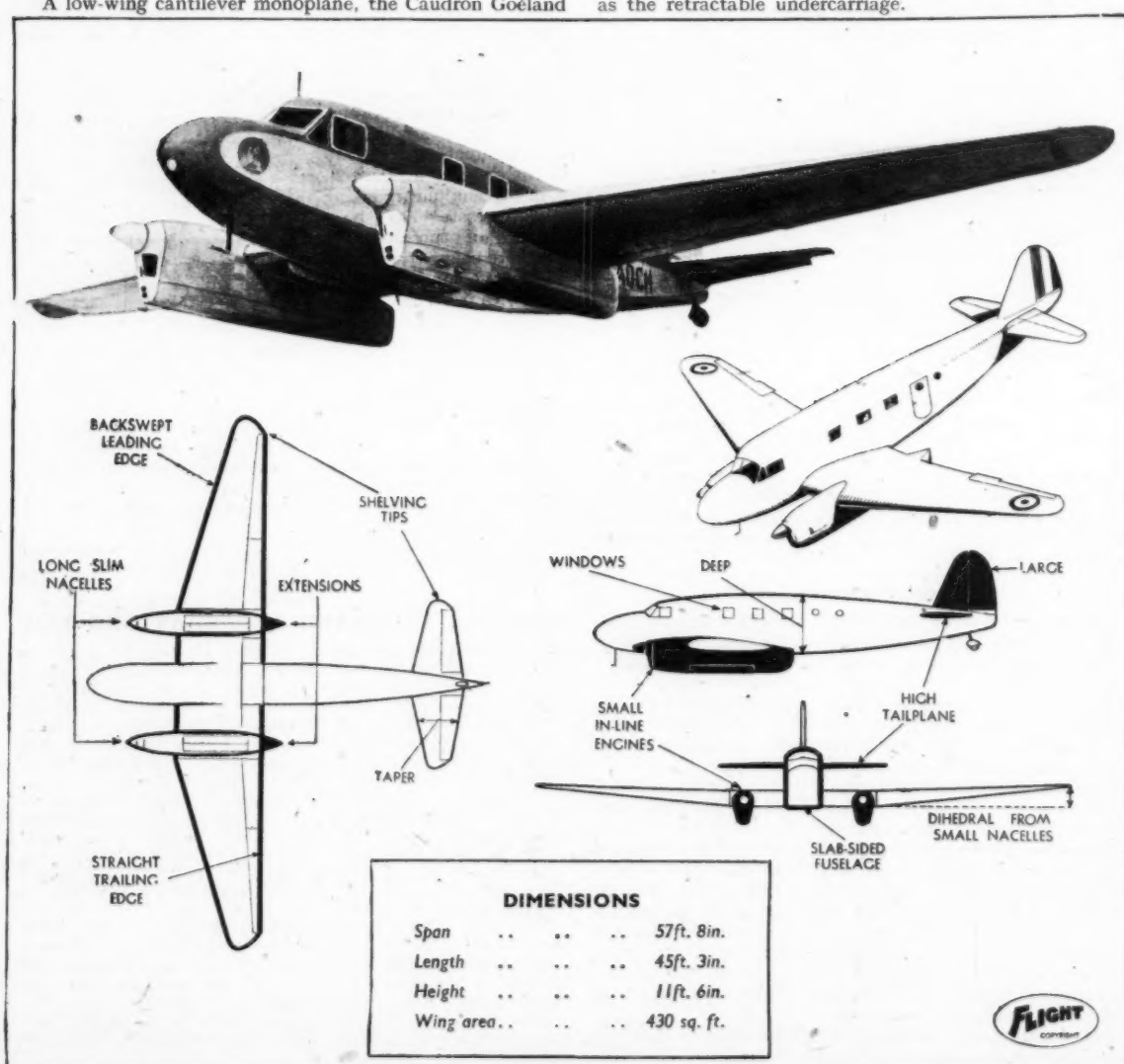
DESIGNED originally as a six-passenger airliner, the Caudron Goéland was in service in considerable numbers in France as a transport and general communications type. After the capitulation many of these aircraft were taken over by the Germans and used by them in Occupied France.

It is interesting to recall that in January, 1941, a Caudron Goéland arrived, unannounced and unexpected, on a Cornish airfield, and from it stepped a young French mechanic who had managed to make his get-away in the machine and had flown it over here from Occupied France. This gift of a free transport aircraft which had been snatched from right under the enemy's nose was a very welcome one, since we were by no means too well blessed with aircraft of any kind at that time, and the Goéland continued to fly on communication duties in this country. The young French mechanic joined the R.A.F.

A low-wing cantilever monoplane, the Caudron Goéland is of wooden construction, the wings having two spruce and plywood spars and a stressed plywood skin, while the fuselage, also a wooden structure, has the nose and decking covered with metal panels and the sides and bottom covered with fabric over light fairing. The fixed tail surfaces are plywood covered, but the rudder and elevators are fabric covered.

Power is provided by a pair of 220 h.p. Renault "Bengali-Six" inverted in-line, six-cylinder air-cooled engines fitted with Ratier v.p. airscrews, and the aircraft's top speed is 186 m.p.h. at sea level and 178 m.p.h. at 6,500ft. Its service ceiling is 16,570ft., and its range 350 miles at a cruising speed of 162 m.p.h. Its size and performance compare approximately with that of the de Havilland Dominie communications type in service with the R.A.F.

The slim engine nacelles, which extend behind the straight trailing edge, can accommodate mail bags as well as the retractable undercarriage.

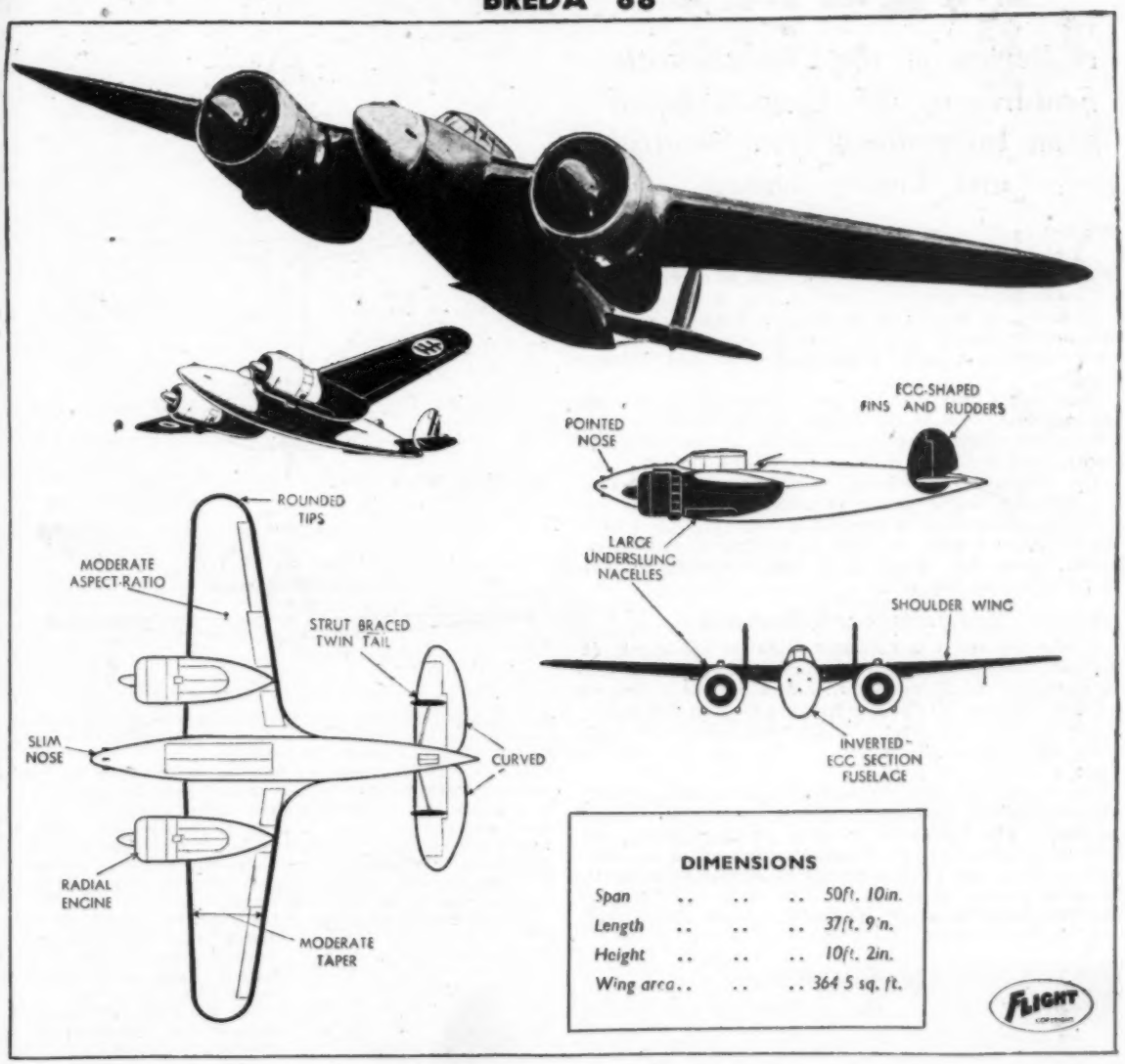


DIMENSIONS

Span	..	..	..	*57ft. 8in.*
Length	..	..	..	*45ft. 3in.*
Height	..	..	..	*11ft. 6in.*
Wing area	..	..	..	*430 sq. ft.*

ndheir Characteristics

BREDA 88



DIMENSIONS

Span	50ft. 10in.
Length	37ft. 9in.
Height	10ft. 2in.
Wing area	364 5 sq. ft.

ALTHOUGH the prototype of the Breda 88 was designed to a multi-purpose formula, the modified production version ultimately went into service with the tactical "assault" squadrons of the *Regia Aeronautica* and, in the summer of 1940, was regarded as one of the most promising of Italy's latest all-metal types.

As will readily be conceded, the Breda 88 is quite an attractive-looking aircraft, having a well-streamlined fuselage and compact proportions. Its two large underslung radial engines and shoulder-wing lay-out give it a business-like air which its actual performance figures amply justify, yet in spite of appearances being all in its favour, it has not proved itself to be a successful operational type, and, when Italy entered the war, its anticipated use against Allied shipping in the Mediterranean did not materialise to any appreciable extent. The type was used to a limited degree in the North African campaign, however, a number of them being duly shot down from time to time and a few captured or destroyed on the ground during the Axis retreat.

The prototype was powered by a pair of French built Gnome-Rhône K 14 air-cooled radial engines, and had a Breda hydraulically-operated dorsal turret housing a single 12.7 mm. machine gun, in addition to fixed armament in the nose, and large windows in the belly of the fuselage for bomb-aiming. The production model, however, is fitted with two Piaggio P Xi RC 40 air-cooled radials each developing 1,000 h.p. at 2,200 r.p.m. at 13,100ft. The dorsal turret gave way to a screened gun position at the rear of the cockpit, where a single manually operated 12.7 mm. machine gun is mounted. The bomb aimer's windows also disappeared from the bottom of the fuselage. Fixed armament in the nose, for the use of the pilot, can be from two to four 12.7 mm. Breda "Safat" machine guns.

Top speed is 320 m.p.h., service ceiling 27,880ft., and cruising range 1,118 miles.

A Russian Fighter

A Review of the Characteristic Features of the Lagg-3, based upon Information from Neutral and Enemy Sources

ONE of the most successful fighter aircraft employed by the Soviet Air Force against the *Luftwaffe* is the Lagg-3. Designed by a team of experts under the leadership of Semen Lavoshkin, one of Russia's top-grade designers, this single-seater fighter has been for some time now in mass production, and acquitted itself well in many combats against Focke-Wulf 190s and Messerschmitts.

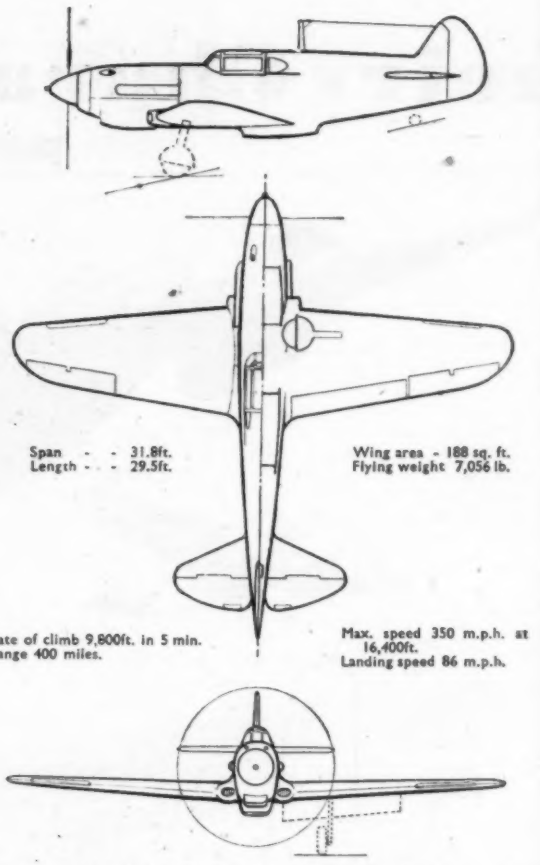
The Lagg-3 has already been superseded by further developments, such as the Lagg-4 and 5, and since it is thus a recent ancestor of a notable line of descendants it merits a detailed study of its characteristics.

The Lagg-3 is of all-wood construction, powered with a 12-cylinder V-type engine of 1,100 h.p., and has the following dimensions: wing span, 9.7 m. (31.8ft.); length of 9 m. (29.5ft.); wing area, 17.5 sq. m. (188 sq. ft.); flying weight, 3,200 kg. (7,056 lb.); and wing-loading, 183 kg./m.² (37.4 lb./sq. ft.).

Performance and Structure

With a top speed in horizontal flight of 350 m.p.h. at 16,400ft., the aircraft has a range of 650 km. (400 miles), an endurance of 1½ to 2½ hr., and a service ceiling of 9,000 m. (29,500ft.). Cruising speed at 5,000 m. (16,400ft.) is 450 km./hr. (279 m.p.h.), and landing speed with flaps down 140 km./hr. (86 m.p.h.). The rate of climb is 3,000 m (9,800ft.) in 5 min.

The wooden monocoque fuselage is well streamlined with a smooth-surfaced plywood skin of 5 to 6 mm. (0.19-0.23in.) thickness. The frames are in birch, plywood-sheathed on both sides, and are spaced irregularly from 400 to 500 mm. (15.7-19.6in.), and have a mean cross-section of 10 to 15 by 30 to 50 mm. (0.39-0.59 × 1.18 to 1.96in.). The plywood employed is a 4-ply Russian birch and the bonding used is a phenol-formaldehyde resin, apparently also used as an impregnating medium, as evident from the heavy coating on the whole interior of the fuselage.

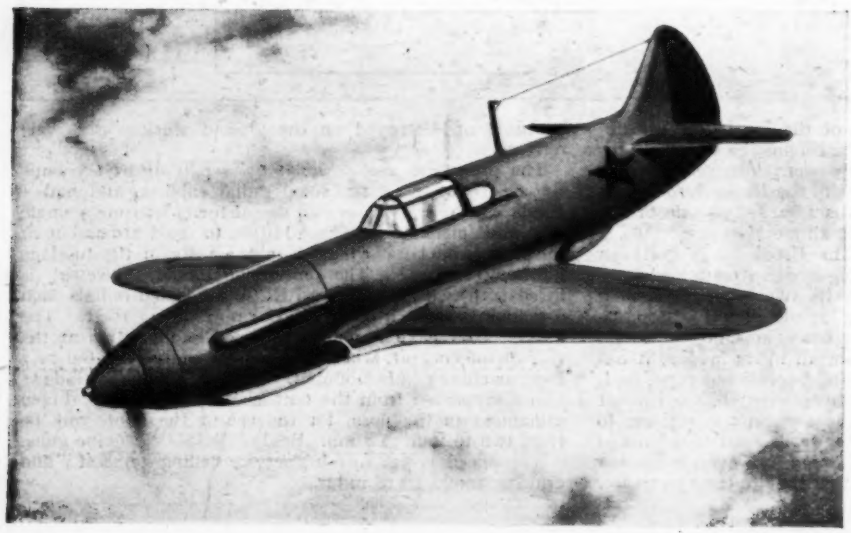

Span - - 31.8ft.
Length - - 29.5ft.
Wing area - 188 sq. ft.
Flying weight 7,056 lb.
Rate of climb 9,800ft. in 5 min.
Range 400 miles.
Max. speed 350 m.p.h. at 16,400ft.
Landing speed 86 m.p.h.

The cockpit hood consists of ordinary Plexiglass mounted on welded tubular steel framework, and slides backwards. It is operated by a leather loop above and in front of the pilot's head, and can be locked in three positions: open, shut, or with a gap of about 50 mm. (1.96in.). Windscreens are also of ordinary Plexiglass, and no emergency release is provided. Forward and side visibility is good, but the rearward field of vision appears to be somewhat restricted.

The three-sectional wings are of trapezoidal plan form with rounded tips, the same type of diagonal plywood skin as the fuselage, and fairly closely spaced ribs.

The low wing is of standard Russian Cahi profile with a maximum thickness ratio of 13 per cent. at 32 per cent. of the chord at the wing root. The chord at the wing root is 2,150 mm. (84.6in.), and the length of the outermost rib is about 750 mm. (29.5in.).

The two box-section wing spars are of all-wood construction with flanges of vertically laminated veneer strips 10 to 15 mm. thick (0.39-0.59in.), each strip being built up of phenol-formaldehyde resin-



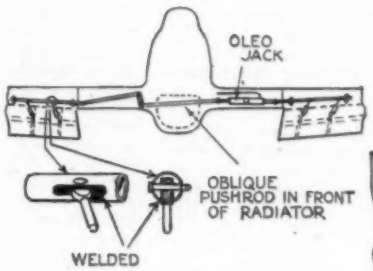
The Lagg-3 single-seater fighter, powered with an M-105P. liquid-cooled 12-cyl. engine, is armed with a 20 mm. cannon, two 12.7 mm. machine guns and carries six rocket fragmentation bombs underneath the wings.

A RUSSIAN FIGHTER

bonded veneers of about 0.2 mm. thickness. Webs of three-ply birch 4.0 mm. thick (0.15in.) are interposed, and the spar sheathed on both sides with 1.5 mm. (0.05in.) three-ply birch. The front spar is 100 mm. thick (3.9in.) and 260 mm. deep (10.2in.) at the wing root, while the corresponding rear spar is 65 mm. thick (2.5in.) and 200 mm. deep (7.8in.). Spar fittings are of welded sheet steel, fitted with eyes for two holding bolts, that for the front spar being 30 mm. in diameter (1.18in.), that for the rear spar 25 mm. (0.98in.).

Exhaust Manifotd.

Wings are equipped with split flaps of duralumin sheet with single piano hinges and operated by pushrods working in duralumin rollers. An accompanying drawing shows how these rods are actuated.



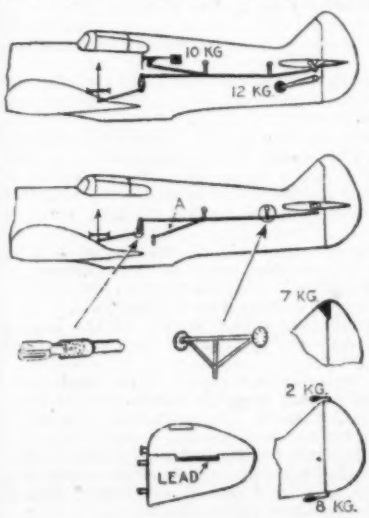
Wing flap arrangement showing the duralumin split flaps operated through a system of levers.

The Undercarriage

The conventionally designed hydraulically operated undercarriage retracts upwards and inwards into pockets in front of the main spar in the centre section. The wheels are light alloy castings with cooling ribs on either side and cross-grooved treaded tyres of 650 x 200 mm. (25.5 x 8.6in.).

The main shock-absorber legs turn on heavy pivots passing through the main spar, and are secured by riveted flanges. For a better distribution of loads, an auxiliary sheet-metal strut is riveted to the wheel axle and bolted to both wing spars. The conical-shaped pivot itself has two cylindrical bearing surfaces working in bronze bushes, press-fitted into the steel head of the leg, the centre line of the leg at an angle of about 105 deg. with the axis of the pivot. Shock absorbers are oleo-pneumatic, and the wheel is guided by reversed toggle links. When the undercarriage is retracted, spats on the outside of the legs fair them entirely into the wing surface.

The tail wheel is also hydraulically operated and retracts backwards. It is locked in the down position by the action of the hydraulic cylinder; in raising the wheel a locking bar is released by the first inward movement of the retracting strut, and the tail leg drops slightly to allow the wheel to retract. The shock-absorber leg is oleo-pneumatic.

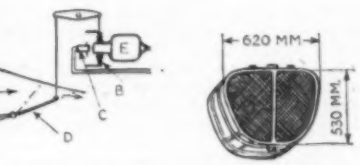


Varied control balances: (Top) By weights; (Centre) Spring device (A); Horn and mass rudder balances.

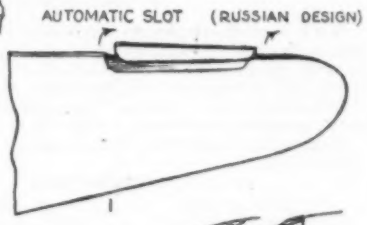
To centre the tail wheel after take-off a tapered spring catch is employed which allows the wheel to swivel only under the influence of sufficient lateral force. An electrical undercarriage indicator is provided on the instrument panel, and mechanical indicators are also fitted on the upper wing surfaces.

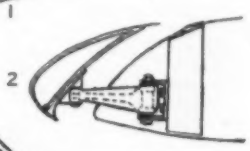
The hydraulic system operating the undercarriage gear and wing flaps features a pressure oil tank in front of and to port of the engine, with the coolant tank placed correspondingly to starboard. An engine-driven pump produces the required pressure and is controlled by a pressure governor with a special gauge on the instrument panel.

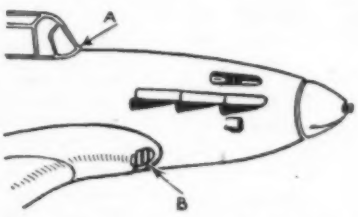
The control valves on the lower instrument panel are each operated by two push-buttons for dropping and retracting respectively. Several non-return valves are incorporated in the circuit. Hydraulic liquid used is a mixture of 65 per cent. glycerine and 35 per cent. alcohol.



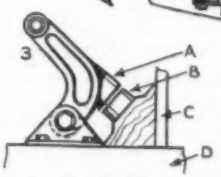
Radiators and Electric Motor: (A) Guide vane with Venturi; (B) Screw; (C) Circuit breaker; (D) Flap; (E) Electric motor.







Nose of Lagg-3. (A) Air intake for windscreen de-icing; (B) Induction air intake.



1. Automatic slot. 2. Bearings. 3. Top view: (A) Stop; (B) Rubber buffer; (C) Strut; (D) Spar.

Balancing of Controls

Brakes are pneumatic, supplied from a cylinder placed behind the pilot's seat and of an approximate capacity of 14 litres with combined reducing and distributing valves controlled from the rudder bar. Double hand brakes are fitted, adjustable by means of a lever on the brake handle. The brakes are operated with the right hand, and the distribution of air to port and starboard effected by the action of the rudder bar.

On the Lagg-3 examined by enemy experts, all control surfaces are fabric covered on metal frames, while the tail-fin (integral with the fuselage) and the tailplane (attached to a special spar at the rear of the fuselage) are of wood. The ailerons are of standard design with partial slot effect and lead-weighted leading-edge balance, and have a differential control.

The elevator has two trimming tabs acting also as servo-tabs and, similarly to the ailerons, is operated by pushrods. The rudder is also fitted with trimming tabs and operated by wires running over wooden rollers on the port side of the fuselage.

Since balancing arrangement of the control surfaces differed in three captured types, it is presumed that it presented some difficulty.

In one case two pendulum elevator balance weights were fitted just aft of the pilot and immediately in front of the tail wheel. These weights—one of 10 kg. (22 lb.) and the other

A RUSSIAN FIGHTER

of 12 to 13 kg. (26.4-28.6 lb.)—are coupled, the rear and heavier weight raising the elevator against the depressing action of the forward one.

In another version the forward weight was replaced by a rudder spring shown in the drawing on page 179, and in yet another case pendulum weights and springs were given up and the control surfaces themselves statically and dynamically balanced.

Again, rudder balancing was in one of the cases reported to be by means of a 7 kg. (15.4 lb.) lead weight on the upper horn balance, while in the second case drop-shaped lead balance weights, one of 2 kg. (4.4 lb.), the other of 8 kg. (17.6 lb.), were fitted above and below the rudder on 20 mm. long (0.78in.) lever arms projecting forward beyond the rudder post.

Power Plant

While later developments, such as the Lagg-5, are equipped with 1,600 h.p. engines, the power plant of the Lagg-3 is the M-105P, a liquid-cooled 12-cylinder V-type engine of 1,100 h.p. employing a boost pressure of about 4 lb. Incidentally, the "P" stands for "pushka," Russian for cannon, signifying the "moteur-canon" type of the engine.

Engine characteristics and performance data are given in the table below:

Engine Data

Cylinder volume	36 litres (7.91 gall.)
Length	2,027 mm. (79.7in.)
Height	960 mm. (37.7in.)
Width	777 mm. (30.3in.)
Weight (dry)	575 kg. (1,267 lb.)
Weight per h.p.	0.523 kg. (1.12 lb./h.p.)
Compression ratio	7:1
Fuel	94 to 95 octane

Performance

	Take Off	Maximum		Cruising	
H.p. ..	1,100	1,100	1,150	900	945
R.p.m. .	2,600	2,700	2,700	2,600	2,600
Altitude	0	2,000 (6,500ft.)	4,000 (13,120ft.)	2,000 (6,500ft.)	4,000 (13,120ft.)

Cylinder blocks are set at 60 deg. with three valves per cylinder, one exhaust and two inlet. There is a separate overhead camshaft for each cylinder block from which the exhaust valves are operated directly and the inlet valves by tee-section rocker arms.

A two-stage two-speed blower is provided, mechanically controlled from the cockpit and with gear ratios of 7.8:1 and 10:1. The six carburettors are of the pressure type.

Crankcase ventilation is provided by air taken in on one side of the engine and passed right across the crankcase and discharged on the other side through a pipe to the rear. Exhaust manifolds are shaped and arranged to make use of the reaction of exhaust gases similar to the arrangement on Rolls-Royce and Daimler-Benz engines.

Radiator and Airscrew

The engine coolant radiator is underneath the fuselage extending half submerged from the trailing-edge of the wing. The radiator block, 400 mm. long (15.7in.), 620 mm. wide (24.4in.) and 530 mm. deep (20.8in.) is in brass. Coolant temperature is controlled by throttling the air intake, either by means of an electrically operated rear louvre or, in the older systems, by manually actuated, independently working front and back louvres.

The half-moon-shaped oil radiator is similarly of brass and is suspended under the front end of the engine crankcase. Radiator ducts are of relatively small diameter and their total height is about 180 mm. (7 oin.). Cooling air is drawn from under the engine mounting, and the outflow controlled by a throttle. On three Lagg types examined by Finnish engineers this throttle control had been dispensed with and radiator louvres locked in a fixed position.

Induction air scoops fitted with guide valves are placed on either side, near the wing-root fillet at the leading-edge of the wing.

The engine drives a three-bladed, all-metal Wisch-61.P airscrew with hydraulic pitch control over about 35 deg., and constant speed governor. The shaft of the airscrew is bored out to accommodate alternatively a 20 mm. Schwak or 23 mm. W.T. engine cannon, and the diameter of the airscrew is 3,000 mm. (9.8ft.) with a blade width of 260 mm. (10.2in.) and a weight of 132 kg. (291 lb.).

The fuel system comprises five fuel tanks, of which three are in the centre section and one in each outer wing panel. All tanks are made of fairly hard aluminium sheet with gas-welded seams and spot-welded wash plates. Bullet-proofing is provided by a complete rubber sheathing over the whole tank, 10 mm. thick (0.39in.) on the bottom and 5 mm. (0.19in.) on the top and sides. It is interesting to note that this protection is not composed of the usual sponge rubber, but consists of a massive rubber cushioning with no fewer than four layers of tough cord fabric, thus resembling in its composition the appearance of a motor tyre.

Fire Protection and Armament

To reduce fire risk, cooled and filtered exhaust gases are led into the fuel tanks by means of a special two-way cock in front of the pilot's seat, and the air in the tanks is thus replaced by inert combustion gases consisting mainly of nitrogen and a carbon dioxide. It may be of interest to give here a brief description of this installation: A welded steel pipe of 50 mm. clear diameter (1.96in.) leads obliquely from the last exhaust stub on the port side and is continued by a steel tube of approximately 1 m. (39.3in.) length and 15 mm. bore (0.59in.). While in this portion light-alloy material is avoided, presumably because of the high temperature of the exhaust gases, the further extension of the exhaust lead is provided by an aluminium pipe which carries the gases down the fuselage until just before the tail. At the tail are two chambers, one of which is filled with copper shavings and apparently acts as a filter, the other being empty and acts as a trap for condensed water.

From these chambers the gas pipe leads along the starboard side of the fuselage to a three-way pressure-gauge equipped cock; when the latter is in a neutral position the exhaust gases can escape directly into the atmosphere through a pipe in the bottom of the fuselage, otherwise the gas passes into a distributing chamber from which it is led by small-bore pipes to the main fuel tanks. The small tank for inverted flying also receives inert gas through a separate pipe.

In some cases the change-over cock was dispensed with and the continuous gas flow to all tanks controlled by relief valves, and it is feasible that the latter system has been adopted in more current practice.

The armament of the Lagg-3, composed of one cannon and two machine guns, is inferior to that of other fighter types, and has been increased in subsequent versions. The two *Beresin* machine guns mounted above the engine and synchronised to fire through the airscrew are of 12.7 calibre, and have a muzzle velocity of 840 m/sec. (2,755ft./sec.) and a rate of fire of 700 to 800 r/m. The length of bore is 1,010 mm. (39.7in.) with an overall length of 1,365 mm. (53.7in.) and a weight of 2,515 kg. (56 lb.).

The 20 mm. (0.78in.) cannon of the Shpitalny-Vladimirov type weighs 40 kg. (88.1 lb.), has a barrel length of 1,700 mm. (64.9in.), and an overall length of 2,155 mm. (84.8in.). The muzzle velocity is 800 m/sec. (2,624ft./sec.), and rate of fire 700 to 800 r/m.

The cannon is mounted between the two cylinder blocks with the long barrel housed in the bore of the airscrew shaft and projecting slightly beyond the spinner. It is a gas-operated, belt-fed type with compressed air storage cylinder fitted next to the cannon and provided with a control valve on top operated by a lever placed between the instrument panel and the reflex sight.

It is of special interest to note that the Lagg-3 carries six rocket fragmentation bombs, each weighing 25 kg. (55 lb.), on special rail racks underneath the wings.

According to reports, the only armour protection available is at the back of the pilot's seat, and is composed of a plate of 9 to 10 mm. (0.35-0.39in.) thickness. No protection is provided underneath and in the opinion of enemy investigators the most vulnerable parts are the coolant radiator and the wing fuel tanks.

Luftwaffe pilots consider the Lagg-3 superior in combat qualities to the Migg-3. On the other hand, according to Finnish pilots the aircraft has a poor acceleration and a tendency to go into a spin when a sharp turn is attempted.

But perhaps the most outstanding feature of the Lagg-3 is its extraordinarily robust "constitution"—the structural strength—and its low weight.

It is impossible to deal with this aspect of the machine in the present review, and we may revert to it at some later date. But it may now be said that the Lagg-3 marks a period of further advance in the technique of Russian wood constructed aircraft, a fact which is borne out by technical evidence from enemy sources. If the Lagg-3 now appears under-armed and perhaps under-powered, it should not be overlooked that it has since been followed by improved versions.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

POST-WAR AIR TRANSPORT

Provincial Airfields Must Follow London's Example

THE plans of the proposed new £20,000,000 post-war London airport are, indeed, a model of perfection and fully justify the high praise and acclamation accorded the general outline of the scheme.

What are the provincial authorities doing in connection with this great British civil aviation expansion programme? So far, there has not been news of any worth-while activity on their part, and I do feel that it would be a serious drawback to the progress of air transport development if some of our airports became quite inadequate to cope with the increased traffic occasioned by the giant liners of coming years.

In support of my statement, I would like to mention the words of Captain K. Bartlett, a director of the Bristol Aeroplane Co., Ltd., who says that "there is a future for flying boats in areas where airfields have not been developed, and where weather and sea conditions do not hamper their use."

With the rapid growth of air travel, which is bound to materialise after the war, the "feeder" system—operated from the network of airfields in this country—will undoubtedly have to resort to larger aircraft, or, alternatively, be abandoned, thus making each route a main line.

ERIC LORRAINE ADLEM.

BOMBER ARMAMENT

Most Important Point Overlooked

WITH regard to the controversy about bomber armament, it seems to me that all your correspondents so far have overlooked the most important point of all—whether there would be any advantage obtained by fitting 0.5in. guns in our bombers.

The heavily armed American bombers were designed specifically for daylight operations, and the conditions which are most suitable for them to operate in are also those which are most suitable for enemy fighters.

Good visibility, which is essential for the daylight operations, enables the enemy to spot the bombers while they are still a long way off; also the Fortresses are unable to make use of cloud cover, for they cannot operate on cloudy days. Therefore they must rely for defence on the fire power of their guns and also to some extent on the close defensive formation they fly in.

Consider now the conditions which are most suitable for our heavy night bombers, namely, thick cloud to and from the target.

Any night fighter-pilot will tell you that if his first attack fails he rarely gets a chance for another one. Hence most night fighters are heavily armed and close in to as near the enemy as possible so as to get the best possible effect from their burst. The 0.303in. machine-gun is then a very efficient defensive weapon, with its high rate of fire, which will tend to throw the enemy off his aim.

By all means let us have heavily armed bombers, but let us be sure first that we are using the right weapon for the job.

HARRY ARCHER.

ONE-TYPE TEST PILOTS

M.A.P. Red Tape that Limits Experience

TEST pilots, other than a firm's chief test pilot, are unable under present arrangements to gain experience on other firms' types except by surreptitiously circumventing the several yards of red tape which at present control testing.

Only firms' chief test pilots are "on the list" at Service Experimental Establishments for flying new types, and other test pilots must obtain M.A.P. "Approval" for (a) type of aircraft, (b) airfield to be used, and (c) type of flying to be done, before they can so much as start up an engine of somebody else's aircraft. Approval normally takes anything from three weeks to three months to obtain, though temporary approval can be given by a firm's M.A.P. Overseer in urgent cases.

This position is ludicrous! It is surely to everybody's advantage for *all* test pilots to have as varied experience of types as possible. Could not the S.B.A.C. or some similar organisation create a *liaison* between firms or between firms and the A.T.A. whereby "A" company's pilots could fly "B" company's products without entering into the tangle of official approval red tape? If such a scheme could be made workable (and the writers suggest that it certainly could), all the firms concerned would benefit from the more numerous criticisms and suggestions from their own and other test pilots, and the pilots themselves would have a far wider outlook on the desirability and suitability of various features in different aircraft, and would therefore become more useful in their profession.

The counter-argument that production pilots are not required to know any other standard than the machine they are currently testing is responsible for the present conditions in which the number of really first class test pilots is rapidly diminishing by the process of elimination, and the pilots who take their place have not had the opportunity of getting the varied experience so desirable in a test pilot. This tendency on the part of chief test pilots to prevent the production pilots from attaining their own standard of experience is a selfish and short-sighted policy into which firms should not allow themselves to be drawn, and may have a very grave effect on the future of the British aircraft manufacturing industry. The fault will lie partly with the industry itself and partly with the Ministry for having so much red tape.

How many times has one been asked, when handing a machine over to a ferry pilot, "How does it compare with a Spit.?" and all one can reply is that one hasn't flown a Spit., or whatever type he happens to choose.

THREE PRODUCTION TEST PILOTS.

REVERSIBLE-PITCH AIRSCREWS

Comparison with V.P. Marine Screws

"B. HAMPTON COURT" (in your July 29th issue) has just not bothered to explore the maze. He accuses me of ignoring the very elementary fact that when the pitch is reversed the relative camber is reversed too, and bases his whole argument against "negative props" as landing-run shorteners on this alone. But I could have told him a much better reason to argue that reversed airscrews would not be fully efficient: namely, that by the time you had got a decently negative pitch on the main body of the blade, the tip would be almost fully feathered, and, therefore, very inefficient indeed (because the tip, having much less positive incidence than the root and middle of the blade, would go into negative, while the root was still in positive or "normal" pitch). It is for these two reasons that, in the letter to which he objects, I referred to the use of "negative props" *on the ground* only, at comparatively slow speeds, because:—

(1) In accelerating from rest to, say, 50 or 70 m.p.h., your "normal props" are shockingly inefficient anyway.

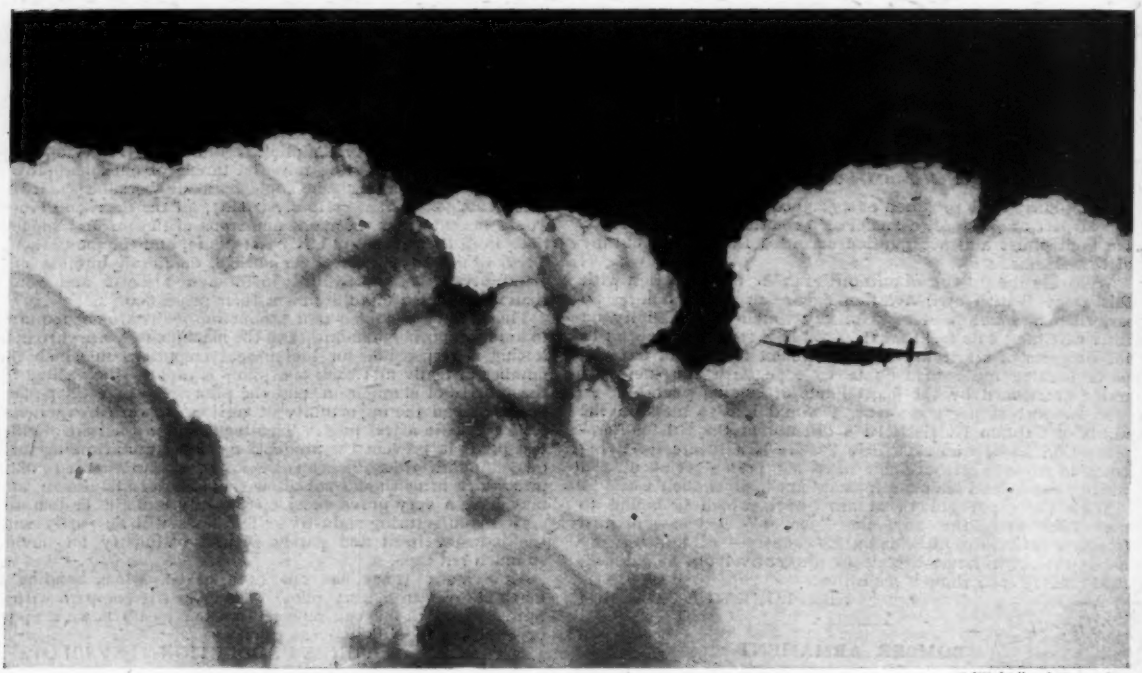
(2) You can get up a good acceleration even in "positive coarse"; indeed, I have seen a Blenheim IV *take off* at Gibraltar, of all places, in "positive coarse" pitch, which means that the airscrews were pretty well stalled—"all drag and no lift."

(3) Providing the carburation allows it, you can fly almost all aircraft (ancient and modern) upside down indefinitely—so the inefficiency of "negative camber" can't be so very considerable.

(4) A few pages before Mr. "Hampton Court's" letter you have an item on the new Rotol v.p. marine screw, which is clearly of reversible pitch, and is used in that manner to make ships stop dead or go backwards; in fact, ships not only reverse the camber of their screws, they even dare to reverse the crankshaft and use the trailing edge of the propeller blade as a leading edge—and they still get along. (And with a marine v.p. screw the problem of the blade tip becoming "very negative" when the rest of the blade is only just negative is obviously greater than with an *air*screw owing to the much greater rate of pitch washout towards the tip.)

(5) Lastly, "B. Hampton Court's" statement that the useful power from a reversed airscrew is "incomparably lower" than that of a normal airscrew is just a bit of unproved and unconsidered generalisation. The only person who can give a really satisfactory answer to this question is one of the professional wind-tunnel wallahs, whose comment I hereby earnestly invite.

"DRIVER."



"Flight" photograph.

THE SILVER LINING: A Halifax flying above thunderclouds.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Promotions

GENERAL DUTIES BRANCH

Air Comdres. (temp.) to be Air Comdres. (war subs.)

C. H. K. EDMONDS, C.B.E., D.S.O. May 18th, 1943.
W. F. DICKSON, C.B., D.S.O., O.B.E., A.F.C. June 26th, 1943.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations.

Distinguished Service Order

Flt. Lt. F. SQUIRE, D.F.C., No. 210 Sqn.—In April, 1943, this officer was captain of an aircraft on anti-submarine patrol in the Bay of Biscay when a submarine was attacked. Flt. Lt. Squire pressed home his attack, diving down to 50 feet before releasing his depth charges. Immediately after the attack an enemy fighter was seen astern and violent evasive action was necessary before it was shaken off.

Bar to Distinguished Flying Cross

Act. Flt. Lt. D. G. S. R. COX, D.F.C., R.A.F.V.R., No. 72 Sqn.—This officer has taken part in a large number of sweeps and patrols and 40 sorties as escort to bombers. During this period he has personally destroyed four enemy aircraft, bringing his total victories to seven destroyed.

Distinguished Flying Cross

Wing Cdr. C. F. READ.

Wing Cdr. C. S. COOPER, No. 254 Sqn.—This officer has taken part in several sorties during which many thousands of tons of enemy shipping have been sunk. In these operations, Wing Cdr. Cooper led the squadron with great skill and dash.

Sqn. Ldr. R. N. LAMBERT, No. 236 Sqn.—This officer has participated in numerous sorties, including several attacks on enemy convoys during which twenty escorting vessels have been hit, a number of them being sunk.

F/O. W. B. FEE, R.C.A.F., No. 98 Sqn.—In June, 1943, this officer captained one of a formation of bombers detailed to attack an industrial target in Belgium. Shortly before reaching the objective the bomber was engaged by enemy fighters. One engine was hit and caught fire, while other equipment was damaged, which caused the bomb doors to fall open and remain hanging. F/O. Fee continued with the formation, however, but was losing height. The enemy made two more attacks in quick succession and the bomber sustained severe damage, making it difficult to control. In spite of this, F/O. Fee succeeded in flying clear and course was set for home. On the return flight, the bomber lost height steadily but, displaying fine airmanship, F/O. Fee flew the damaged aircraft to this country and effected a successful crash-landing at an airfield near the coast.

F/O. K. H. OWENS, R.C.A.F., No. 37 Sqn.—This officer has completed a large number of sorties, most of which have been in the Middle East. In this theatre he has attacked a wide range of targets, latterly in Tunisia, Sicily and Pantellaria.

P/O. K. R. PAY, R.A.F.V.R., No. 10 Sqn.—In June, 1943, this officer was the rear gunner of an aircraft detailed to attack a target at Le Creusot. During the flight his aircraft was engaged by an enemy fighter. Coolly and skilfully, P/O Pay instructed his captain as to the necessary evasive action and, at the same time, used his guns with effect. Three of his guns jammed, but he succeeded in clearing them as the attack closed in and, with a devastating burst of fire, caused the enemy aircraft to dive steeply towards the sea when it exploded on hitting the water. He has destroyed three enemy aircraft in combat.

F/O. J. F. ANDREWS, R.A.F.V.R., No. 115 Sqn.—F/O. Andrews and Sgt. Mason were pilot and rear gunner respectively of an aircraft detailed to attack Mulheim. One night in June, 1943, whenover the target area, the bomber was hit by anti-aircraft fire and, almost immediately, was attacked by an enemy fighter. Sgt. Mason skilfully drove off the aircraft with accurate gunfire, however, and the target was successfully bombed. Shortly afterwards, the bomber was again hit by fire from the ground defences whilst illuminated by the searchlights. One of the port engines and part of the fuselage caught fire. At this moment another fighter was observed at close range, but it was driven off by the rear and mid-upper gunners. The flames inside the fuselage were put out by means of an extinguisher whilst, by violently diving the aircraft, F/O. Andrews succeeded in extinguishing the flames in the affected engine. He then flew the damaged bomber safely to base.

F/O. W. D. PARSONS, R.A.A.F., No. 464 (R.A.A.F.) Sqn.—In June, 1943, F/O. Parsons and Sgt. McConnell were pilot and air gunner respectively of an aircraft detailed to attack a target in France. During the flight, the aircraft was attacked by an enemy fighter from close range. The port elevator was shot away and the trimming tabs were completely jammed; the turret was also struck and rendered useless, while Sgt. McConnell was wounded in both hands and hurled through the turret door. Nevertheless, he quickly re-entered the turret and, when further attacks developed, gave such concise and well-timed directions that his pilot was enabled to outmanœuvre the attacker. In spite of many difficulties, F/O. Parsons flew the damaged bomber to this country.

Sqn. Ldr. R. H. MCINTOSH, A.F.C., R.A.F.O., No. 280 Sqn.—This officer has taken part in numerous operational air/sea rescue sorties, many of which have been in adverse weather. He has always set a magnificent example to the younger members of his squadron by his keenness, energy and devotion to duty.

Maj. D. E. D. MEAKER, S.A.A.F., No. 16 Sqn.—This officer has led his flight on numerous very successful bombing and low level attacks and has completed several hazardous sea patrols in very bad weather. Maj. Meaker was also primarily responsible for the destruction of five enemy aircraft on the ground.

Act. Sqn. Ldr. C. L. G. HOLMES, No. 150 Sqn.—Since joining this squadron in December, 1942, Sqn. Ldr. Holmes has completed many daring attacks. His work in training aircrews has been exceptionally good, his example being an inspiration to them and largely responsible for their success.

Flt. Lt. E. S. DAWSON, R.A.F.V.R., No. 608 Sqn.—This officer began his operational career as an air gunner in the East African campaign. He flew in 25 bombing raids, and on one occasion, after his pilot had been killed, he successfully shot down an Italian fighter before his own aircraft crashed. As squadron gunnery officer, he has been continuously engaged on operational duties since April, 1942. Flt. Lt. Dawson has completed many anti-submarine patrols over the Danish and Norwegian coastal waters, and later in the North African theatre of war.

Flt. Lt. D. HEWITT, R.A.F.V.R., No. 201 Sqn.—Flt. Lt. Hewitt has flown 690 hours on operational flying on which 182 hours have been by night. In March, 1943, he made a successful attack on an enemy submarine.

Flt. Lt. A. S. JACKSON, No. 119 Sqn.—Flt. Lt.

Jackson, now on his third tour of operational duty, has been continuously engaged on flying duties since the beginning of the war. He has displayed a fine sense of duty.

Flt. Lt. W. KNOWLES, R.A.F.V.R., No. 220 Sqn.—Flt. Lt. Knowles has taken part in a large number of operational sorties, including two skilful and determined attacks on U-boats. On each occasion the enemy submarine was probably destroyed.

Flt. Lt. G. P. ROBERSON, R.A.F.V.R., No. 220 Sqn.—During eight months of continuous anti-submarine operations, this officer has displayed vigilance and determination. In February, 1943, he sighted a U-boat and immediately made a most skilful and determined attack.

Flt. Lt. W. ROXBURGH, R.A.F.V.R., No. 206 Sqn.—This officer has made several effective attacks on U-boats in the Atlantic and took part in the "1,000 bomber" raid on Bremen. On that occasion his aircraft was severely damaged by anti-aircraft fire on the way to the target. A petrol tank was holed and instruments put out of action. This did not, however, deter Flt. Lt. Roxburgh from bombing the target successfully and flying his aircraft safely to base.

Act. Flt. Lt. J. V. GIBSON, R.C.A.F., No. 119 Sqn.—In April, 1943, Flt. Lt. Gibson was captain of an aircraft engaged on a night operation in the Bay of Biscay. The aircraft became unserviceable and was brought down on to the sea. During the subsequent period all the crews succeeded in getting to the dinghy in which they drifted for fifteen hours. Throughout this trying and difficult experience Flt. Lt. Gibson maintained a high morale among his crew and displayed great coolness and initiative.

Four U-boat Attacks

Act. Flt. Lt. W. E. WILLITS, D.F.M., No. 233 Sqn.—Since this pilot joined his squadron for his second tour of operations he has attacked four submarines. In April, 1943, while on patrol, a U-boat was sighted which made no attempt to submerge. Flt. Lt. Willits engaged it with his front guns as he flew in to drop his depth charges which straddled the submarine. The U-boat then began to submerge but by clever manœuvring, Flt. Lt. Willits was able to attack it again with a well-placed bomb.

Act. Flt. Lt. A. B. HOWELL, R.C.A.F., No. 423 Sqn.—In March, 1943, this officer was captain of an aircraft detailed to complete an anti-submarine patrol. In the course of this mission he made two separate attacks on enemy U-boats, inflicting casualties and damage. These attacks were delivered with great skill and determination, the second in the face of anti-aircraft fire.

Act. Flt. C. R. MCMILLS, R.C.A.F., No. 252 Sqn.—This officer has displayed an admirable offensive spirit throughout a long and successful tour of duty. He has taken part in numerous sweeps against enemy shipping and transport, both by land and sea, causing much damage. In the course of these missions, Flt. Lt. McMills has shared in the destruction of several enemy aircraft.

Act. Flt. Lt. H. C. RIGBY, R.A.F.V.R., No. 81 Sqn.—This officer has assisted in the destruction of two enemy aircraft and has damaged others. In April, 1943, Flt. Lt. Rigby gallantly engaged a number of enemy aircraft which were threatening to bomb an airfield. He also took part recently in a daring and effective attack on a submarine.

Capt. G. H. KAUFMAN, S.A.A.F., No. 2 Sqn.—Over a period of fifteen months Capt. Kaufman has displayed continuous gallantry in the Western Desert and has to his credit at least three enemy aircraft destroyed.

F/O. D. A. BERESFORD, R.C.A.F., No. 269 Sqn.—In April, 1943, this officer was captain of a Hudson aircraft on anti-submarine patrol. A U-boat was sighted surfacing two miles away. F/O. Beresford immediately dived to attack and released his depth charges within three seconds of the U-boat submerging.

F/O. J. R. BREW, R.A.F.V.R., No. 541 Sqn.—F/O. Brew has completed many successful operational sorties. In February, 1943, he spent 35 minutes over Berlin in the course of which much valuable photographic data was secured. On many other occasions he has accomplished fine work of a similar character often in the face of intense anti-aircraft fire. In April, 1943, a long damage assessment sorties to Rostock and Stettin was successfully completed by F/O. Brew, who was forced by lack of petrol to make a "dead engine" landing on his return. This was done successfully without damage to his aircraft. In spite of bad weather, this officer has seldom failed to obtain good photographs.

F/O. E. F. CASTELL, R.A.F.V.R., No. 233 Sqn.—F/O. Castell, now on his second operational tour, has completed a large number of operational sorties. On seven occasions he has attacked U-boats with skill and has fought off an attack by an enemy aircraft. This officer has also taken part in a number of air/sea rescue operations, and has been instrumental in several rescues. In March, 1943, he was captain of an aircraft which sighted a fully surfaced U-boat. Despite accurate and intense anti-aircraft fire, F/O. Castell made a low-level attack. He continued the attack for over an hour, till darkness fell and his ammunition was exhausted.

F/O. L. G. CLARK, R.A.F.V.R., No. 206 Sqn.—F/O. Clark has taken part in a large number of operational sorties. He took part in the "1,000 bomber" raid on Bremen in June, 1942, and prior to that completed several very successful operations in which he helped to reform scattered convoys and gave escort to many more. A fearless and determined captain of aircraft, this officer has attacked enemy U-boats in all weather, pressing home his attacks with an entire disregard of danger and achieving much success.

F/O. J. D. COUSINS, R.A.F.V.R. No. 458 Sqn.

SERVICE AVIATION

—F/O. Cousins has participated in a large number of operational sorties. On one occasion in February, 1943, the airspeed indicator of the aircraft in which this officer was flying as navigator became unserviceable. In spite of intermittent cloud, he continued to navigate by astro navigation and successfully completed his patrol.

F/O. J. H. DOUGLAS, R.A.F.V.R., No. 458 Sqn.—During his tour of operational duty this officer has been engaged on shipping searches and mine-laying and naval co-operation patrols. One night in January, 1943, as captain of aircraft, he was detailed for a shipping search and sighted a large enemy merchant vessel escorted by a destroyer. His accurate directions enabled a striking force to attack and as a result the merchant vessel was sunk and the destroyer left burning and sinking. Three days later this officer sighted another enemy merchant vessel in the Sicilian narrows and immediately attacked it. Despite intense and accurate anti-aircraft fire, which hit his aircraft three times, F/O. Douglas pressed home the attack, obtaining a hit, which sank the vessel.

F/O. J. W. P. DRAPER, R.C.A.F., No. 111 Sqn.—During the campaign in North-West Africa, F/O. Draper has destroyed three enemy aircraft and shared in the destruction of a fourth. On one occasion he brought his aircraft into collision with an enemy aircraft, causing its destruction without serious damage to his own.

F/O. L. A. FIELDHOUSE, R.A.F.V.R., No. 70 Sqn.—This officer has taken part in a large number of operational sorties, fifteen of which

F/O. P. D. Wood, No. 605 Squadron, who has been awarded the D.F.C.

were against Tobruk. Several times his aircraft has been damaged by anti-aircraft fire, but this has never daunted him from completing his mission successfully.

F/O. E. J. HAUGEN, R.C.A.F., No. 202 Sqn.—A highly skilled officer, F/O. Haugen has, at all times, devoted his entire energies to his duties. As navigator, he has taken part in three determined attacks on U-boats, one by night and two by day.

F/O. P. T. MUIRHEAD, R.A.F.V.R., No. 295 Sqn.—In February, 1943, during a bombing attack on a power station, F/O. Muirhead's aircraft was hit several times by anti-aircraft fire and damaged. A shell burst in the cockpit, wounding him severely in the feet. Despite this, he pressed home his attacks with great determination. The rudder controls and most of the flying instruments were now out of action and petrol was leaking from the starboard engine, but, assisted by his navigator, F/O. Muirhead, though in considerable pain, flew the aircraft safely to base.

F/O. G. E. PALMER, R.A.F.V.R., No. 23 Sqn.—Since joining this squadron, F/O. Palmer has flown on a large number of intruder sorties over France, Holland, Sicily, Italy and North Africa, during which he has attacked enemy installations, airfields and transport. In March and April, 1943, this officer shared in the destruction of two enemy aircraft.

F/O. G. K. PICKERING, R.A.F.V.R., No. 142 Sqn.—This officer is an efficient and conscientious bomb aimer, who has on many occasions refrained from dropping his bombs until he has made certain of the correct aiming point. He has taken part in a large number of operational missions which he has invariably completed effectively.

F/O. A. STEWART, R.A.F.V.R., No. 540 Sqn.—F/O. Stewart has completed a large number of photographic reconnaissances. Each one of his sorties has been marked by a determination to complete the mission successfully regardless of adverse weather.

F/O. J. H. STRIEBEL, R.C.A.F., No. 23 Sqn.—F/O. Striebel has taken part in a large number of operational sorties from Malta and Great Britain. He has completed many successful patrols over enemy airfields in France, Holland and Belgium. Later he gained conspicuous success in operations when based at Malta. During January, 1943, in North Africa, his unrelenting attacks caused great destruction of road transport between Tripoli and Sfax. He also set fire to a factory and attacked several small enemy vessels in the face of intense and accurate anti-aircraft fire, returning on one occasion with his aircraft almost disabled.

Lt. P. ATKINS, S.A.A.F., No. 24 (S.A.A.F.) Sqn.—Lt. Atkins has completed a large number of missions in the course of his operational career. He has invariably displayed a high degree of courage and keenness during operations.

Lt. L. A. FEINBERG, S.A.A.F., No. 24 (S.A.A.F.) Sqn.—Lt. Feinberg has taken part in a large number of operational sorties. As an air gunner in the East African campaign he completed 30 sorties before being severely wounded when his aircraft was shot down. Since resuming operations this officer has led many successful raids.

Lt. O. P. MARAIS, S.A.A.F., No. 16 Sqn.—This officer has served with distinction throughout the Abyssinian and Libyan campaigns. As an air gunner in Abyssinia he displayed outstanding skill and courage and has continued to do excellent work on sea patrols and photographic reconnaissances. He has also taken part in bombing raids.

Lt. D. C. MARSH, S.A.A.F., No. 20 (S.A.A.F.) Sqn.—During the campaign in Abyssinia, Lt. Marsh displayed outstanding skill and courage as an air gunner. Since then he has been employed as a navigator and observer on a number of sea patrols and photographic reconnaissances. On one occasion his aircraft located three stranded airmen and on another he participated in the capture of Pamanzi Island.

Lt. R. H. VAN DER POEL, S.A.A.F., No. 40 Sqn.—This officer has participated successfully in many tactical reconnaissance flights. He has completed many difficult and hazardous tasks, often at low levels and in adverse weather. In January, 1943, while on a reconnaissance flight his aircraft was shot down in the Zuard area, and crashed at high speed in difficult country, behind the German lines. Though wounded, Lt. Van Der Poel displayed the greatest courage and initiative in evading capture and eventually joined his squadron.

Mosaics of Turin and Spezia

P/O. J. T. LEACH, R.A.F.V.R., No. 540 Sqn.—By his efficiency and enthusiasm as a navigator, this officer has contributed greatly to the high standard maintained by his crew on operations. Many excellent results have been obtained. In February, 1943, he completed a photographic reconnaissance of Turin and Spezia. After completing five runs over Turin and two over Spezia his aircraft was intercepted by enemy aircraft, but safety was gained in the clouds.

W/O. R. N. B. STEVENS, R.A.A.F., No. 3 Sqn.—W/O. Stevens commenced operational flying in June, 1942, when his squadron was continuously engaged in low-level attacks on enemy concentrations. Later, when his squadron was assisting in breaking the Alamein line, this airman displayed the most outstanding courage and devotion to duty, particularly when leading formations on raids. Although W/O. Stevens' aircraft has been shot down on several occasions and on others his aircraft has been badly damaged in air combat and by enemy ground fire, his keenness and fine fighting spirit has in no way been diminished.

Act. Flt. Lt. I. G. S. KELTIE, R.C.A.F., No. 403 Sqn.—Flt. Lt. Keltie has completed a very large number of operational sorties, including 75 sweeps over enemy territory. Possessing exceptional qualities of leadership and administrative ability, this officer has led the squadron on many successful operations.

Act. Capt. J. F. O. DAVIES, S.A.A.F., No. 12 Sqn.—Capt. Davies has completed a large number of operational sorties, both by day and by night. An extremely capable operational pilot, he has led the squadron on numerous occasions with the utmost confidence and skill.

F/O. D. C. BUNCH, R.A.F.V.R., No. 219 Sqn.—This officer has been continuously employed on operational flying for the past two years eight months. During this period he has been responsible for the destruction at night of three enemy aircraft.

F/O. A. E. GREGORY, R.A.F.V.R., No. 275 Sqn.—This officer has a long and meritorious record of service as an air gunner, having been engaged in night flying for nearly three years.

F/O. N. A. KEENE, R.C.A.F., No. 417 (R.C.A.F.) Sqn.—F/O. Keene has taken part in a large number of operational sorties. He has completed 73 operational sweeps over enemy territory and has destroyed at least one enemy aircraft and damaged others.

Lt. P. J. DU PREEZ, S.A.A.F., No. 12 Sqn.—Lt. Du Preez has participated in a large number of operational sorties against enemy airfields, road and mechanised transport, first as an air gunner and latterly as an observer.

P/O. W. W. J. LOUD, R.A.F.V.R., No. 602 Sqn.—P/O. Loud has completed a large number of operational sorties, including shipping reconnaissances. He has destroyed at least one enemy aircraft and damaged others.

Act. Wing Cdr. W. L. JONES, No. 115 Sqn.—Wing Cdr. Jones has been engaged on operational duties for over a year and has gained a wide experience of operational flying both by day and night. He has completed sorties against targets both in Western Europe and Burma.

Act. Wing Cdr. H. C. STUMM, R.A.F.O., No. 11 Sqn.—This officer has taken part in many operations since the outbreak of war. He has led his wing on numerous daring sorties against the enemy in Burma, and throughout he has main-

SERVICE AVIATION

tained a high standard of skill, courage and devotion to duty.

F/O. O. R. CHAPMAN, R.N.Z.A.F., No. 268 Sqn.—F/O. Chapman has taken part in a number of operational flights over Holland and off the Dutch coast, often in the face of intense anti-aircraft fire.

F/O. E. W. DUNLOP, R.A.F.V.R., No. 60 Sqn.—F/O. Dunlop has completed a large number of operational flights over Burma. He has guided his aircraft, through extremely bad monsoon weather and over mountainous country, safely to the target and back, achieving excellent results. This officer has served as leading navigator/bomb aimer on many occasions, and has also been the navigator/air gunner in several low-level attacks against enemy shipping in a defended harbour.

F/O. A. R. HILL, R.A.F.V.R., No. 268 Sqn.—This officer has taken part in many operational sorties of a varied nature, including shipping reconnaissances, escorts and an air/sea rescue patrol. The majority of his flights have been over Holland and off the Dutch coast, and he has brought back valuable information. During the course of his operational career F/O. Hill has had a number of combats with enemy aircraft, but has always succeeded in flying safely back to base. He has damaged one enemy aircraft and numerous enemy ships, barges and locomotives.

F/O. D. S. LORD, No. 31 Sqn.—This officer has completed a very large number of operational sorties in Iraq, the Western Desert and in Burma. His duties in Burma included the evacuation of casualties, women and children, often in the face of severe opposition. During the past two months he has done admirable work, dropping food supplies to troops in the field. His sorties have often taken him deep into enemy territory, frequently without fighter escort, and have called for courage and endurance of a high order.

F/O. T. E. D. MITCHELL, No. 268 Sqn.—This officer has taken part in many operational sorties, mainly over Holland and the Dutch coast, in the course of which he has damaged enemy communications. Several times he has been engaged in air combat with hostile aircraft but has always succeeded in flying safely back to base.

W/O. H. A. CHANDLER, R.N.Z.A.F., No. 615 Sqn.—W/O. Chandler has taken part in a large number of operational sorties over enemy territory in Burma. Many of these have been low-level attacks involving flights of more than 200 miles to the target over hilly country. He has also participated in three low-level attacks on the airfield at Magwe in the fact of intense opposition from the ground defences, and has also completed several operations at night. On one occasion the engine of this warrant officer's aircraft was hit by anti-aircraft fire and he was forced to land just north of the enemy's lines. In January, 1943, whilst returning from an attack on enemy shipping and without any ammunition left, he was attacked by Japanese fighters. Although his aircraft was hit several times and he was himself wounded in the head, W/O. Chandler, with fortitude and skill, succeeded in flying safely back to base. He has destroyed one enemy bomber in air combat.

Bar to Distinguished Flying Medal

Flt. Sgt. K. GREENE, D.F.M., No. 9 Sqn.—One night in June, 1943, this wireless operator-air gunner displayed great initiative in dealing with an ignited incendiary bomb, while his aircraft was flying over the target area. Flight Sgt. Greene's prompt action averted a serious catastrophe and contributed much to the safety of his aircraft.

Distinguished Flying Medal

Sgt. W. B. MASON, No. 115 Sqn.—For citation see F/O. ANDREWS, D.F.C.

Sgt. B. A. MCCONNELL, No. 464 (R.A.A.F.) Sqn.—For citation see F/O. PARSONS, D.F.C.

Sgt. A. D. GARLICK, No. 102 Sqn.—One night in June, 1943, this airman was the wireless operator of an aircraft which attacked Dusseldorf. When approaching the target area the bomber was subjected to anti-aircraft fire and Sgt. Garlick was hit in the face and neck by fragments of shrapnel, suffering a broken jaw and losing much blood. Displaying great fortitude, he refrained from informing his comrades of his injuries until the target had been bombed and the aircraft was clear of the area.

Flt. Sgt. (now P/O.) J. R. CHUBB, No. 540 Sqn.—This airman has completed a large number of photographic reconnaissances. In September, 1942, he completed a mission to North Russia in extremely bad weather. Cloud was continuous all the way. Nevertheless, Flt. Sgt. Chubb's skilled navigation brought the aircraft out of cloud only 30 miles from his destination.

Flt. Sgt. T. HASTY, No. 179 Sqn.—This airman's crew sets a high standard both in general conduct and in operational ability while engaged in anti-submarine patrol work; he has made three attacks on U-boats, all of which have been very effective.

Flt. Sgt. P. J. JAMES, S.A.A.F., No. 24 Sqn.—As air gunner, Flt. Sgt. James has completed a large number of operational sorties. His work, both in the air and on the ground, has been of the highest order.

Flt. Sgt. R. LEES, No. 70 Sqn.—Throughout his tour of operations, Flt. Sgt. Lees, as navigator/bomb aimer, has displayed exceptional skill and determination. During the battle of Alamein, owing to engine trouble, he was forced to leave his aircraft by parachute. Having landed safely, this airman made his way through German patrols, rejoined his unit, and immediately started operational flying again, with undiminished ardour.

Flt. Sgt. D. H. LYONS, No. 202 Sqn.—This airman has taken part in a large number of operational sorties. In March, 1943, the aircraft in which he was serving as air gunner was on convoy escort duty when two Fw. Kurriers attacked the convoy, one endeavouring to make a low-level attack. By accurate firing Flt. Sgt. Lyons silenced the mid-upper gun of the hostile aircraft and the attackers broke off the engagement.

Sgt. C. J. ALLEN, No. 142 Sqn.—This airman has displayed high qualities of efficiency and skill as a wireless operator/air gunner. His courage and determination throughout numerous operations have been highly commendable.

Sgt. P. BOND No. 142 Sqn.—Sgt. Bond has maintained a high standard of excellence in his work as a navigator. He has participated in many bombing raids over Germany, Italy and Tunisia, in which his navigational skill has proved most valuable.

Sgt. W. W. COOKE, No. 179 Sqn.—Sgt. Cooke has completed many operational sorties, many of which have been night anti-submarine operations. On four occasions Sgt. Cooke has participated in successful attacks on enemy U-boats, which have been pressed home with great determination, regardless of the heavy opposition encountered.

Sgt. D. A. DRIVER, No. 104 Sqn.—Sgt. Driver has taken part in a large number of operational sorties against targets in Sicily and Tunisia. Throughout he has shown great determination and zeal in bombing the target, and on four occasions has descended to ground level to attack searchlight batteries and concentrations of enemy transport and troops. On one occasion, during an attack on Tunis docks, despite accurate and heavy anti-aircraft fire, this airman pressed home his attack with such effectiveness as to obtain a hit on an enemy tanker.

Sgt. W. G. FENNELL, No. 142 Sqn.—This airman has completed a large number of successful operational sorties. On more than one occasion his skill in obtaining wireless aid has largely contributed to the safe return of his aircraft and crew.

GLOBAL WAR: The new operations map for Coastal Command headquarters. It is 20ft. high by 30ft. wide.

Sgt. A. E. FIELDER, No. 210 Sqn.—This airman has displayed great enthusiasm and keenness for anti-submarine work and took part recently in a very effective attack on a U-boat.

Sgt. H. G. LOVELL, No. 142 Sqn.—Sgt. Lovell has completed many sorties. His crew has an outstanding operational record to which his skill and courage have largely contributed.

Sgt. J. MANUEL, No. 142 Sqn.—Sgt. Manuel has served with this squadron since October, 1942, and has completed numerous operational sorties. Many of these have been difficult and dangerous missions accomplished in the face of adverse weather and heavy ground defences.

Sgt. H. RICHARDSON, No. 120 Sqn.—This airman has participated in a large number of reconnaissances, anti-shipping strikes and convoy escorts. On one occasion a hydraulic pipe-line burst, rendering the landing gear and automatic pilot unserviceable. Sgt. Richardson repaired the fracture, thus enabling the aircraft to land safely. More recently, with a piece of wire, he made a new fusing link, which was missing from a depth charge, as a result of which his crew were able to make a successful attack on an enemy submarine.

Sgt. A. G. SMITH, R.C.A.F., No. 415 (R.C.A.F.) Sqn.—In April, 1943, Sgt. Smith was air gunner in an aircraft detailed for strike against a blockade runner in the Bay of Biscay. During the attack the aircraft was hit several times by anti-aircraft fire, Sgt. Smith being wounded in many places in his right leg. Despite the considerable pain he was suffering, this airman continued taking photographs which later proved of great value.

Sgt. E. H. SMITH, R.N.Z.A.F., No. 415 (R.C.A.F.) Sqn.—This airman was wireless operator in an aircraft detailed to attack a very heavily escorted blockade runner in the Bay of Biscay. During the attack the aircraft was hit and set on fire. Large flames and smoke appeared inside the fuselage. Sgt. Smith attacked the flames and eventually succeeded in extinguishing them, though parts of the aircraft continued to smoulder. Although scorched about the hands and face, he finally got the fire under control and the aircraft returned safely to base.

Night Gunnery

Flt. Sgt. H. LE R. BERGH, S.A.A.F., No. 12 (S.A.A.F.) Sqn.—This air gunner has taken part in a very large number of operational sorties. Flt. Sgt. Bergh has accomplished outstanding work, and his gunnery at night, whilst making low-level attacks on enemy airfields, mechanised transport or concentration of troops, has been exceptionally consistent and accurate.

Flt. Sgt. W. ELDER, R.A.F.V.R., No. 276 Sqn.—This airman has been engaged on air/sea rescue operations since June, 1941, resulting in the rescue of numerous members of aircrew. On one occasion he participated in a search within two miles of Cherbourg.

Flt. Sgt. P. KIRBY, No. 276 Sqn.—In the first year of the war this airman took part in a number of attacks on enemy territory, including a daylight attack on Heligoland, and night attacks against targets at Bremen, Cologne, Hamburg and Hamm. Since then he has flown on 60 air/sea rescue searches, one of which resulted in a rescue approximately three miles off Cape Griz Nez and two others involving flights to the Guernsey area.

Flt. Sgt. J. MACKENZIE, No. 104 Sqn.—Flt. Sgt. McKenzie has had a long and varied career on operational flying, during which he has made attacks at Stavanger, Mannheim, Kiel, Brest, Berlin, Northern Italy, and in the Middle East. In October, 1940, he was first wireless operator in an aircraft, which, when returning from Milan, flew into a severe electrical storm, which rendered the wireless set unserviceable. Flt. Sgt. Mackenzie, with great skill and determination, repaired the set, and later, when the aircraft was forced to alight on the sea, his excellent wireless directions were largely responsible for the rescue of the crew.

Sgt. L. G. BADGER, No. 276 Sqn.—Over a period of two years Sgt. Badger has participated in a large number of air/sea rescue searches, during which a number of lives have been saved. His skill and courage in picking up these airmen from the sea has been of a high order.

Flt. Sgt. F. W. DIXON, R.A.A.F., and Sgt. A. ROSEN, both of No. 467 (R.A.A.F.) Sqn.—These airmen were captain and flight engineer respectively of an aircraft detailed to attack Mulheim one night in June, 1943. When nearing the target area the bomber was hit by anti-aircraft fire while illuminated by searchlights. The fuselage, mainplanes and one engine were damaged. The windscreen on one side of the pilot's cabin was shattered and Sgt. Rosen was injured in the eye and in the face. Nevertheless, Flt. Sgt. Dixon evaded the defences and successfully bombed the target, afterwards flying the damaged aircraft back to base. During the action, Sgt. Rosen, in spite of his painful injuries, executed his duties coolly and efficiently and refused to leave his post for attention until the bomber was clear of the enemy coast.

Sgt. D. C. CAMERON, Sgt. A. K. YOUNG and Sgt. G. B. YOUNG, R.A.A.F., all of No. 158 Sqn.—One night in June, 1943, these airmen were captain, mid-upper and rear gunners respectively of an aircraft which attacked Mulheim. Shortly after bombing the target, the aircraft was illuminated by searchlights and subjected to heavy anti-aircraft fire. The bomber was repeatedly hit and sustained damage. Sgt. Young, the rear gunner, received facial injuries and temporarily lost consciousness. He was given first-aid by the mid-upper gunner, and on recovery he coolly beat out the flames from some burning equipment with his gloves. Meanwhile, Sgt. Cameron skilfully evaded the defences and

and, displaying great determination, flew the damaged bomber to an airfield in this country.

Sgt. G. FALLOON, R.C.A.F., No. 158 Sqn.—One night in June, 1943, this airman was the flight engineer of an aircraft detailed to attack a target at Le Creusot. During the operation, the aircraft was hit by anti-aircraft fire and fragments of shrapnel severed the petrol cock control cables and an oil pipe line which caused a considerable quantity of oil to flow into the fuselage. Sgt. Falloon was unable to operate the petrol cocks, or ascertain the source of the oil leak, without entering the wing. By means of an axe he made an aperture in the side of the fuselage and thus was able to crawl into the wing and fulfil his task.

Sgt. B. MOON, R.A.A.F., No. 37 Sqn.—As observer, this airman has participated in numerous sorties, including operations against targets in Sicily, Tripolitania, Pantellaria and Tunisia. On several occasionos, in extremely adverse weather, his skilful navigation has contributed materially to the safe return of his aircraft.

Flt. Sgt. (now P/O.) E. L. J. ANDERSON, R.A.A.F., No. 11 Sqn.—This airman has taken part in operations against targets in Europe, Western Desert, Syria, Iraq, Ceylon and Burma. While engaged in operations over the Western Desert, Flt. Sgt. Anderson, on one occasion, flew his aircraft back to base, a distance of 250 miles, on one engine. Another time he landed safely in the open desert with wheels down, both engines having failed. In Ceylon this airman participated in an attack on fighters. Following this engagement he reached base safely although his aircraft was riddled with bullets and its tyres punctured. During the last three months Flt. Sgt. Anderson has completed many operational sorties against the enemy on the Burma front.

Flt. Sgt. F. J. BARNES, No. 268 Sqn.—Flt. Sgt. Barnes has participated in many operational sorties. During operations over Holland and off the Dutch coast he has had several encounters with enemy fighters. He has destroyed at least one enemy aircraft.

Flt. Sgt. F. A. HARBOARD, No. 60 Sqn.—Flt. Sgt. Harboard has flown on a very large number of operations against enemy targets in Europe, the Middle East and Burma. On many of these flights he has served as leading navigator/bomb aimer.

Act. Flt. Sgt. F. ROBINSON, No. 270 Sqn.—As captain of a flying boat this airman has been singularly successful in long and arduous convoy escort duties and anti-submarine patrols. On two occasions he has successfully located rafts and assisted in the rescue of survivors. During other patrols he has sighted damaged and sinking ships.

Flt. Sgt. W. E. ELDER No. 76 Sqn.—This airman was the captain and pilot of an aircraft which was detailed to attack Krefeld one night in June, 1943. On the outward flight one engine of the bomber became unserviceable, but, despite this, Flt. Sgt. Elder continued to the target and pressed home a determined attack, afterwards flying the aircraft back to base.

THE KING has been graciously pleased to approve the following awards:—

M.B.E. (Mil.)

P/O. R. E. YOUNG, R.C.A.F.—On three occasions this officer, who is employed on armament duties, has displayed outstanding gallantry and coolness in the face of imminent danger. In February, 1943, he supervised the demolition of a 500 lb. bomb which had been dropped by accident on the airfield, and, a few days later, he rendered harmless two mines when the aircraft carrying them crashed while taking off. In similar circumstances on another occasion, P/O. Young dismantled a 4,000 lb. bomb within five minutes of the crash

Military Cross

F/O. H. F. MARTING, R.C.A.F., No. 450 (R.A.A.F.) Sqn.

George Medal

F/O. G. A. OSBORN, R.A.F.V.R., No. 161 Sqn.—This officer has on two occasions displayed great gallantry in rescuing members of his crew from burning aircraft. When serving as an instructor at an O.T.U. he was engaged in testing a Whitley, which crashed and burst into flames. F/O. Osborn, who was thrown clear and was uninjured, immediately re-entered the aircraft and dragged clear the observer, who was badly injured. In effecting this rescue, F/O. Osborn suffered severe burns about the hands and was in hospital for six weeks. In March, 1943, F/O Osborn was captain and pilot of an aircraft which crashed shortly after taking off on an operational flight. The aircraft was soon enveloped in flames and ammunition and verey lights were exploding. F/O. Osborn was dazed but succeeded in extricating four injured members of the crew from the wreckage. In so doing he was badly burnt about the hands, arms and face. Though in a state bordering on collapse, he did all he could to ensure that every member of his crew had been extricated before he was finally persuaded to receive attention.

Flt. Sgt. D. C. MOORE, R.C.A.F., and Sgt. H. WILSON, R.N.Z.A.F., both of No. 214 Sqn.—One evening in March, 1943, Flt. Sgt. Moore and Sgt. Wilson were captain and rear gunner respectively of an aircraft which crashed into a house soon after taking off, burst into flames and was completely wrecked. Most of the crew, although badly burned or injured, managed to escape through holes torn in the fuselage. Flt. Sgt. Moore emerged from the pilot's escape hatch, went to the rear of the aircraft, and re-entered the wreckage, which was now a raging inferno with bullets exploding; high explosive bombs were also carried. He found the mid-upper gunner trapped and unconscious against the mainspar, with his feet resting on the roof and his head on the floor. Calling for help, Flt. Sgt. Moore was immediately joined by Sgt. Wilson, who was badly cut about the head, and together they entered the blazing bomber and succeeded in extricating their unconscious comrade, Sgt. Wilson sustaining burns about his face and body in the process. Although almost completely exhausted, the two airmen carried the mid-upper gunner across a wire fence and over a deep ditch to a small enclosure sufficiently far from the aircraft to be comparatively safe. Sgt. Wilson then set out across the ploughed fields in search of help while Flt. Sgt. Moore, who was suffering intensely from burns, remained to encourage and sustain his injured crew.

Sgt. C. L. PUDNEY, R.C.A.F.—While engaged on a local practice flight, the Halifax aircraft in which Sgt. Pudney was flying as mid-upper gunner struck high ground, crashed and burst into flames. Three members of the crew were killed and the others, with the exception of Sgt. Pudney, were too severely injured to extricate themselves from the burning wreckage. Though suffering from severe lacerations on his face, and in spite of loss of blood and shock, Sgt. Pudney entered the blazing aircraft several times and finally succeeded in bringing all his companions out. He then struggled over rough moorland for two miles to obtain help.

Cpl. T. W. CHELLOW, No. 607 Sqn.—One morning in January, 1943, an aircraft crashed on taking off and caught fire. Cpl. Chellow, the N.C.O. in charge of the fire tender, was quickly on the scene of the accident, but it was impossible to bring the tender within 200 yards of the crash owing to the difficult terrain. With complete disregard for his own safety, Cpl. Chellow entered the wreckage and extricated an injured airman. He succeeded in extricating two more bodies from the wreckage. Although the aircraft was burning fiercely and small arms ammunition was exploding, while two 250 lb. unexploded bombs remained on the aircraft, Cpl. Chellow continued to search for the fourth member of the crew. He finally located the body pinned beneath the propeller. With assistance he removed the engine and the propeller and then dragged the body clear.

Distinguished Service Medal

A/C.1 R. O'NEILL, R.A.F. Regiment.—In June, 1942, this airman was proceeding to Malta in a vessel which, owing to its slow speed, was forced to drop out of convoy and was attacked by enemy aircraft. During the engagement, A/C. O'Neill helped to man one of the guns and remained at his post until blown from it by a bomb. Though wounded in the arm, he later volunteered to assist the captain to rig the hand-steering gear, and only when this proved useless did he leave the ship. While in the water he made successful efforts to save the lives of two of his comrades.

Cpl. T. H. MOULD, A.A.F., No. 942/3 Sqn.—Cpl. Mould has been in charge of a mobile drifter since November, 1935, during which time he has displayed great courage, fortitude and devotion to duty in numerous actions against enemy mine-laying aircraft. On June 3rd, 1941, he observed a Ju 88 approaching his vessel at an altitude of about 1,500 feet. He promptly attacked the aircraft with machine-gun fire and it was seen to crash into the sea. On another occasion when a Ju 88 flew in to attack his vessel, he coolly withheld his fire until he was sure of his aim and destroyed the aircraft. Cpl. Mould has badly damaged three other enemy aircraft, and his vessel has always been to the fore in reporting enemy aircraft and mines.

AXIS TANK BUSTER: Pilots of "The Fighting Cocks" squadron in Sicily on an Me 109 left behind by the Germans. Note the large bore cannon fitted under the wing *à la* Hurricane IID.

Roll of Honour

Casualty Communiqué No. 263

THE AIR MINISTRY regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 101 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. D. A. O'Dowd; W/O. C. Pigdon; Sgt. D. H. Richardson; Sgt. R. Sherwood; P/O. R. R. Walters.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. I. K. Crawford; Sgt. D. Fisher; Sgt. T. J. Fraser; Sgt. A. F. Gardner; Sgt. H. I. Goodwell; P/O. R. L. Hage; Sgt. K. D. Jones; Sgt. J. J. Kearns; Sgt. R. H. Kirkpatrick; Sgt. W. C. Meachon; Sgt. A. Murray; Sgt. P. F. Newman; Sgt. W. J. Nobbs; Flt. Sgt. R. Owen; Sgt. J. W. Rowling; Sgt. F. K. A. Seals; Sgt. A. K. Smith; Sgt. J. H. Stirk; Sgt. R. G. Ware; Flt. Sgt. C. A. Whiteside.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. H. Beyer; Sgt. L. C. Bray; Sgt. L. Burnett; Sgt. H. F. Burton; Sgt. C. C. W. Crofton; Sgt. H. V. M. Davenport; Flt. Sgt. J. G. E. Davis; P/O. P. Dawson; Sgt. F. G. Drewry; Act. Flt. Lt. D. S. Gillett; Sgt. H. E. Goldie; Flt. Sgt. W. Graham; Sgt. A. F. Haden; P/O. R. H. W. Hatt; Sgt. D. F. J. Hinde; Sgt. E. A. Holland; Sgt. F. B. Hough; Sgt. W. E. Hudson; Flt. Sgt. E. R. Hunting; Sgt. F. W. Huntley; F/O. R. G. D. Jaggard; P/O. A. J. Knell; Act. Sqn. Ldr. R. M. Lloyd, D.F.C.; Flt. Sgt. L. Lothian; Flt. Sgt. W. E. S. Luck; Sgt. J. P. Martin; Sgt. J. M. S. Moir; Flt. Sgt. J. C. Morgan; Sgt. J. Noble; F/O. J. E. Northend; Sgt. H. G. Le B. R. Pakenham-Walsh; Flt. Sgt. J. Rimmer; Sgt. E. Roberts; Sgt. J. S. Sagar; Sgt. G. W. Scott; Flt Sgt W. Shankland; Flt. Sgt. P. Silverman; Sgt. K. R. W. Simmonds; Sgt. G. A. Smith; Sgt. P. H. Smith; Sgt. L. A. C. Standen; Flt. Sgt. A. J. Sutton; Act. Flt. Lt. C. Thomas; D.F.C.; Sgt. E. Watcham; Sgt. J. Weir; Flt. Sgt. R. G. West; Flt. Sgt. W. R. Wilson; Sgt. E. C. Woollard; Flt. Sgt. P. S. Woolston.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. E. A. Beckwith.

WOUNDED OR INJURED IN ACTION.—Sgt. G. A. Colkett, D.F.M.; Sgt. A. B. Smith; Sgt. G. J. Wood.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. H. P. Calvert; Sgt. S. Llewellyn.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. G. Ambler; Flt. Sgt. J. H. Atkinson; Sgt. H. W. Austin; Sgt. T. R. Bayles; F/O. H. L. Beesley; Sgt. E. F. Crossman; F/O. B. G. Evans, D.F.M.; Act. Sqn. Ldr. J. T. Hanafy; Flt. Sgt. A. J. Hebblewhite; Sgt. A. Herbert; Sgt. J. Hird; Sgt. C. P. Hutton; Sgt. L. E. Jones; Sgt. E. W. Lord; Sgt. E. W. Mathews; Sgt. A. S. Penney; Sgt. D. Purvis; Sgt. J. Rowe; Sgt. E. B. Smith; Sgt. R. Smith; W/O. E. L. Watts; Sgt. W. H. Wild; Flt. Sgt. J. A. Williams.

MISSING.—Sgt. A. Aitken; Sgt. C. B. Anderson; Sgt. W. Antcliffe; Sgt. H. Ashton; Sgt. C. W. Astle; Sgt. R. J. Avann; Sgt. R. F. F. Baggaley; Flt. Sgt. E. S. Bawden; Sgt. W. R. Beadsmoore; Sgt. R. Bell; Sgt. W. J. Bennett; Sgt. W. H. Bestwick; Sgt. D. Birkhead; Sgt. S. Booth

SERVICE AVIATION

royd; P/O. J. R. Bullock; Sgt. M. T. Byrne; Sgt. A. Campbell; Sgt. E. C. Church; Sgt. C. Clarke; Sgt. P. M. Cosgrove; Sgt. H. Coupe; Sgt. P. Daly; Sgt. E. G. David; Sgt. A. Drury; Sgt. F. W. Farnell; Sgt. J. P. Fitchett; P/O. M. E. Flower; Sgt. G. H. Garrard; Sgt. S. J. Gaywood; Sgt. D. W. Glover; Sgt. C. Greenhalgh; Sgt. A. Hall; Sgt. E. Hall; Sgt. P. Hemingway; Sgt. A. K. Henderson; Sgt. C. J. J. Hine; Sgt. T. L. V. Hitchcock; Sgt. J. Holmes; F/O. R. G. Houston; Sgt. R. T. A. Hudson; Sgt. F. J. Jarvis; Sgt. I. A. Jervis; Act. Sqn. Ldr. P. Johnston, D.F.C.; P/O. J. W. T. King; Sgt. H. Kleiner; P/O. K. R. Langhorne; Sgt. A. R. Leslie; F/O. B. C. McGrath; Sgt. M. J. J. Maher; Sgt. W. A. Manning; Sgt. J. H. Mastin; Sgt. W. V. Morris; P/O. J. R. Morton; Sgt. T. Musgrove; Sgt. H. D. Newberry; Sgt. W. E. Oliver; Sgt. J. W. G. Parker; Sgt. P. Parkin; P/O. D. A. Pitchers; Sgt. F. J. Prothero; Sgt. F. R. Pym; Sgt. W. B. Rawnsley; Sgt. W. J. Rees; Sgt. D. W. Riddle; Sgt. D. Robb; Sgt. T. Robson; Flt. Sgt. E. A. Roede; Sgt. F. C. Rose; Sgt. E. Short; Sgt. D. J. Smith; Sgt. J. C. Smith; Sgt. D. G. A. Storey; F/O. P. R. C. Sykes; Sgt. E. Thomas; Sgt. F. Thompson; Sgt. W. F. Turner; Sgt. J. R. S. Waller; Sgt. C. A. Warnes; Sgt. N. C. Watling; Sgt. S. J. Wayman; Sgt. C. F. S. Wells; F/O. A. B. P. Wilson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. H. K. Barker; P/O. R. Bridge; Sgt. E. C. J. Hill; Sgt. J. H. Newton.

KILLED ON ACTIVE SERVICE.—L.A/C. G. S. Hosh; Sgt. W. A. D. McConnell; Sgt. H. G. H. McCready; Sgt. J. B. C. Methven; Sgt. A. R. Nicholls; Sgt. E. F. J. Oliver; Sgt. R. G. Ordish; Sgt. A. Orr; Flt. Sgt. B. F. Snell, D.F.M.; Sgt. W. A. Stewart; Flt. Sgt. H. E. Tyas.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. G. K. Hamilton; P/O. J. T. Howdle; Sgt. R. Pontin.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. W. B. Chittack; Sgt. R. C. Cooper; Sgt. T. K. Fewings; Sgt. V. J. Landrey; L.A/C. J. S. William.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. M. N. Williams.

DIED ON ACTIVE SERVICE.—L.A/C. A. E. Bland; A/C.2 G. A. Greenham; L.A/C. G. McClelcan; L.A/C O. L. Faull; W/O. R. C. Rankin; L.A/C. E. Sansum; A/C.1 E. C. Toovey

Royal Australian Air Force

KILLED IN ACTION.—P/O. C. L. Cubitt; P/O. R. J. Stokes; P/O. N. F. D. Simpson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. A. I. L. Downs; Sgt. B. P. Shaddick.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. K. C. Bennett; Flt. Sgt. E. K. F. Brasher, D.F.M.; Flt. Sgt. H. H. Brien; Sgt. W. R. S. Cornish; Sgt. A. D. Crowther; Flt. Sgt. I. V. Heatley; Sgt. D. W. Johnson; Flt. Sgt. D. Kerr; Sgt. P. L. Looney; Flt. Sgt. A. J. Marfell; Sgt. C. E. J. O'Keeffe; F/O. O. J. Sanderson.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. T. H. Greenhalgh.

MISSING.—Sgt. A. E. Chapman; F/O. E. K. Chivers; F/O. R. S. Giddey; Flt. Sgt. F. J. O'Grady.

KILLED ON ACTIVE SERVICE.—Sgt. J. M. Brown.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. R. B. Byers; P/O. J. W. Clarke; Sgt. W. G. Hopps; F/O. E. F. Paige, D.F.C.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. D. R. Dewar; Flt. Sgt. S. A. Goss; Sgt. J. E. R. Lavigne; Sgt. D. Mann; P/O. A. W. Stevenson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. C. A. Beach; Sgt. B. Carroll; Sgt. L. S. Ernest; Sgt. S. G. Gray; Flt. Sgt. A. G. Johnston; Flt. Sgt. M. McArter; Sgt. G. T. Reyburn; Sgt. J. E. Rodgers.

WOUNDED OR INJURED IN ACTION.—Sgt. L. G. Collins; P/O. A. P. McCracken.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. R. M. Costello; F/O. W. H. N. Pearce; W/O. W. R. Thompson.

MISSING.—Sgt. E. H. Alderson; Sgt. D. L. Beatty; Sgt. A. F. Birkbeck; F/O. S. A. Bishop; F/O. J. M. Colvin; Sgt. E. J. Cotton; Sgt. J. Hooper; Sgt. J. Y. Houston; P/O. F. H. Hubbs; Sgt. L. R. Lamoure; Sgt. G. E. J. Lebihan; Flt. Sgt. T. R. Livermore; Sgt. R. M. Mingay; Sgt. G. D. Nisbett; Flt. Sgt. S. Pennington; Sgt. R. M. Ricketts; Sgt. D. Slobotsky; Sgt. N. C. Swann; Sgt. R. E. Talman; P/O. M. Uretzky; Sgt. S. G. Ward; P/O. J. K. Watson; P/O. G. S. Wilson; Sgt. F. E. Winegarden.

KILLED ON ACTIVE SERVICE.—Cpl. J. L. Johnston; Sgt. G. J. Rankmore.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. Miller.

MISSING.—Flt. Sgt. R. J. Baxter; Sgt. S. M. Tietjens; Sgt. F. J. L. Joblin; Sgt. G. W. Turnbull.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. F. G. Addis; Flt. Sgt. F. D. Thomson.

South African Air Force

KILLED ON ACTIVE SERVICE.—Lt. J. S. L. Jackson.

Casualty Communiqué No. 264

Of the names in this list 104 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. W. C. Beck; Sgt. E. G. Brooke; F/O. G. E. Dean; Sgt. G. A. F. Johnston; P/O. E. A. Norton; P/O. H. G. Sherwood; Act. Flt. Lt. W. S. D. Sutherland.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. S. Balfour; P/O. W. Barfod; Sqn. Ldr. P. R. Barr; Sgt. A. MacK. Cockie; Sqn. Ldr. C. M. Howell; P/O. H. W. Long; Sgt. L. Tate; P/O. T. Trotter.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. P. J. Apps; Sqn. Ldr. H. W. Barnard; P/O. P. H. Basson; Sgt. E. A. Bouffler; Flt. Sgt. A. B. Brooks, D.F.M.; Sgt. F. R. Carter; Flt Sgt. D. G. Chackfield; Sgt. A. H. Clayton; Sgt. S. A. Curtis; Sgt. J. G. Duncan; Sgt. E. Ferguson; F/O. C. W. Harris; Flt. Sgt. I. J. A. Henderson; Sgt A. S. Hoad; P/O. W. A. L. Ireland; Flt. Sgt. H. L. J. MacKender; P/O. D. B. Moody; Sgt. R North; Flt. Sgt. E. O'Hara; Flt. Sgt. P. J. Paine; Flt. Sgt. J. J. Perry; Sgt. J. M. Pye; Sgt. J. A. Richards; Flt. Sgt. C. R. Russell-Collins; Sgt. K. Seddon; F/O. O. D. Thomas; Act. Sgt. G. W. A. H. Vasil; Sgt. W. Waller; Sgt. L. E. Webster.

WOUNDED OR INJURED IN ACTION.—Sgt. G. Martin.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. D. H. G. Adams; Sgt. R. J. Ayres; Sgt. E. Cavill; Sgt. F. C. Cleaver; P/O. J. B. Denton; Sgt. P. Grimwood; Sgt. R. Hageman; Flt. Sgt. M. Harrison; Sgt. I. B. Inglis; Sgt. G. H. Lawson; Sgt. L. Marshall; Sgt. L. J. Miles; Sgt. H. J. Morris; Sgt. N. P. Plenderleith; Sqn. Ldr. E. F. St. Aubyn; Sgt. L. R. Smith; Sgt. A. E. Wallis.

MISSING.—Sgt. R. Adair; Sgt. E. D. Ager; Sgt. R. C. Ainsworth; P/O. A. Armstrong; Sgt. P. Arnott; Sgt. J. L. Atha; Sgt. S. F. Barrow; Sgt. C. W. Bates; Sgt. R. Batterbee; Sgt. D. L. Beresford; Sgt. K. G. Berry; Sgt. L. D. Bryant; Sgt. W. H. Bryant; Flt. Sgt. F. W. Capes; Sgt. G. E. Chadfield; Sgt. R. C. Child; Sgt. L. M. Chisnall; P/O. B. E. Cooper; Flt. Sgt. J. L. R. Cooper; Sgt. E. W. Cosnett; Sgt. R. F. Coverdale; Flt. Sgt. D. E. T. Crosland; Sgt. J. Currie; Sgt. R. Dean; F/O. H. J. H. Debnam; Sgt. F. O. Detley; Sgt. W. Easson; Sgt. A. W. Edgley; Sgt. W. J. Erdbeer; P/O. D. W. Erickson; Sgt. C. R. Fleming; Sgt. J. T. Francis; Sgt. E. A. French; Flt. Sgt. M. O.D. Fuller; Sgt. E. Garner; Sgt. L. T. Gibson; Sgt. Z. Goldfinger; Sgt. J. Grant; Flt. Sgt. R. T. Hall; F/O. D. Harvey; F/O. W. C. Haylock; Sgt. G. Henderson; Sgt. J. Hogg; F/O. C. L. Houedard; Sgt. J. Hudson; Sgt. J. T. E. R. Leadbetter; Sgt. H. Lloyd; Sgt. R. Lowe; Sgt. K. MacIntosh; F/O. J. M. Marnoch; Sgt. S. J. Maxted; Sgt. G. J. Mitchener; Sgt. T. B. Morris; P/O. R. E. Newman; Sgt. R. H. Oats; F/O. C. F. O'Connell; F/O F. Openshaw; Sgt. T. C. L. Orchard; Sgt. D. P. O'Riordan; F/O. A. H. Pelham-Clinton; Sgt. R. W. Pittard; Flt. Sgt. J. L. Poulter; Sgt. A. J. Railton; Sgt. C. Rees; Sgt. E. Rowlands; P/O. G. Russell; Sgt. A. J. Sales; Sgt. E. Shackleton; P/O. J. Shepherd; Sgt. T. C. E. Simmonds; Sgt. J. Simmons; Sgt. A. N. Stonestreet; Sgt. R. V. Street; Sgt. H. G. Thomas; Sgt. E. A. Thompson; Sgt. A. R. Tickner; Sgt. R. A. Tilbury; Sgt. V. J. S. Tindale; Act. Sqn. Ldr. P. R. Turgel, D.F.C.; Sgt. R. Wadsworth; Sgt. V. N. Walker; Sgt. H. Ward; Sgt. J. G. Watkins; Sgt. L. R. Whatley; Sgt. H. R. B. Whyatt; Sgt. A. T. M. Wright; P/O. I. A. Wynn.

KILLED ON ACTIVE SERVICE.—Cpl. H. Allen; Sgt. C. S. Anderton; A/C.2 G. R. Band; Sqn. Ldr. B. E. R. Bowden; Sgt. N. Charnell; F/O. E. Creed; Sgt. R. J. Duncan; Sgt. C. J. A. Ferguson; P/O. H. D. Francis; A/C.2 W. A. Gravell; L.A/C. H. A. Green; P/O. F. Hopkinson; L.A/C. H. Hudson; L.A/C. J. Lenaghan; A/C.2 A. J. Sammons; W/O. V. A. Slouder; A/C.1 J. S. Thomson; A/C.2 W. R. Whitehouse; L.A/C. F. Wilson; Sgt. P. E. Zoeller.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. P. B. Kember.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—A/C.1 J. S. Holt; Sgt. N. E. Spenceley.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 E. A. Barton; A/C.1 A. Orr; A/C.2 K. M. Savage; A/C.2 F. D. Speed; A/C.2 T. S. F. White; A/C.2 A. Naylor.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. H. Berry.

DIED ON ACTIVE SERVICE.—Sgt. H. Blackburn; L.A/C. A. L. Bliss; L.A/C. J. Carden; A/C.2 R. J. Creswick; L.A/C. A. H. Denny; Sgt. J. R. Duthie; A/C.2 E. Fearnley; L.A/C. D. Havard; Cpl. H. W. C. Hudson; A/C.2 A. Hughes; L.A/C. L. C. Lowe; L.A/C. D. P. MacGavin; L.A/C. J. J. Maguire; Cpl C. F. Pepper; A/C.2 I. Pilgrim; Cpl. L. H. Saville; L.A/C. W. M. Scott; A/C.2 R. S. Stewart, Cpl. D. Waugh; Act. Sqn. Ldr. W. Wilson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. F. P. Goodridge; Sgt E. G. Greenhill.

Women's Auxiliary Air Force

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/CW.1 V. A. Clowes

DIED ON ACTIVE SERVICE.—A/CW.1 J. Burnett; A/CW.2 B. Williams.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. D. T. McLean; Sgt. R. D. McPherson; Sgt. R. R. B. Owen; Sgt. A. G. Smith; Sgt. L. W. Stephenson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. Brook; Flt. Sgt. R. A. Buntine; Flt. Sgt. G. R. Ferguson; P/O. W. L. V. Hallet; Sgt. W. J. Hoban; Sgt. C. P. Jenkins; F/O. G. R. Lind; Sgt. J. Power.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. B. M. T. Davis; Sgt. K. D. Dyce; Sgt. J. O. Wilson; Flt. Sgt. C. S. Wright.

MISSING.—Flt. Sgt. J. S. U. Biffen.

KILLED ON ACTIVE SERVICE.—Sgt. C. B. Crabbe; Sgt. A. Kerrigan; Sgt. I. E. Kirk.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. F. A. R. Milbury; Sgt. H. D. G. Ward.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. M. Andrews; P/O. W. H. Donovan; Sgt. R. K. Griffith; P/O. J. D. McLeod; Flt. Sgt. E. D. Moye; P/O. J. F. Nicolle; P/O. M. J. O'Sullivan; P/O. J. H. R. Paradis; Flt. Sgt. N. S. Phillips; P/O. J. F. Stokes; Sgt. J. O. Tuller.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. P. Begley; Sgt. P. W. B. Box; Sgt. A. L. Carou; Sgt. R. J. Edgar; Flt. Lt. C. W. J. Fernie; Flt. Sgt. G. A. Firman; Sgt. W. W. Lee; P/O. R. S. Masur; Sgt. C. R. Moore; P/O. P. D. Mosher; Flt. Sgt. A. D. Nightingale; P/O. D. W. Ross; Flt. Sgt. J. H. Rowney; P/O. J. A. Smith.

MISSING.—F/O. G. H. Carson; P/O. C. K. Coker; Sgt. M. G. K. East; Sgt. J. W. Evans; Sgt. R. R. Mantha; Sgt. E. S. Pollon; P/O. H. N. Petts; Sgt. F. W. Ralph; Flt. Sgt. C. T. Smith; Flt. Sgt. H. Sponsler; Flt. Sgt. E. A. Sproule; Sgt. R. W. Stanley; Sgt. A. S. Thomson; F/O. I. S. Thomson; Sgt. W. H. Wyatt; P/O. G. W. Young, D.F.C.

KILLED ON ACTIVE SERVICE.—Cpl. W. G. Abbott; Sgt. G. Assaf; F/O. G. S. Hynam, D.F.C.; Flt. Lt. G. W. Mason; P/O. E. J. Ross; Sgt. J. L. Soos.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. D. C. McDonald.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. G. E. Laidlaw; Sgt. J. A. McLeod.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Act. W/O. C. C. Hill; P/O. D. M. Logan.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. J. V. Gustolson; Sgt. L. F. T. Johns; F/O. M. G. McNeill.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. T. G. Clark; Sgt. D. S. Oldridge.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. K. C. Brown; Sgt. D. G. Crail; F/O. N. R. Holmes; Sgt. R. L. A. McFarland; Sgt. H. W. Pike; Flt. Sgt. H. J. Price;; Flt. Sgt. L. P. Russell; Flt. Sgt. R. V. Snook; P/O. J. C. Webster.

MISSING.—P/O. A. W. Flack; Flt. Sgt. C. L. Saundercock; Sgt. R. A. F. Woods.

KILLED ON ACTIVE SERVICE.—P/O. E. E. Pedersen.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. G. A. Butt.

South African Air Force

KILLED IN ACTION.—Lt. B. Merrington.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Lt. N. B. Boyd; Lt. L. A. Carnovski; 2/Lt. D. De Klerk; Lt. A. M. Duncan; Air Sgt. F. Olivier.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. I. Brown; Flt. Sgt. J. A. Colverd; Lt. A. M. Donnelly; Lt. E. Jones; 2/Lt. R. F. Marrillir.

DIED ON ACTIVE SERVICE.—Sgt. W. J. Hulley.